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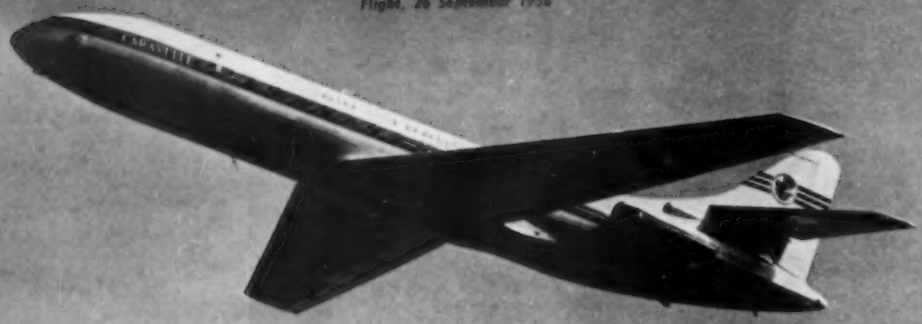

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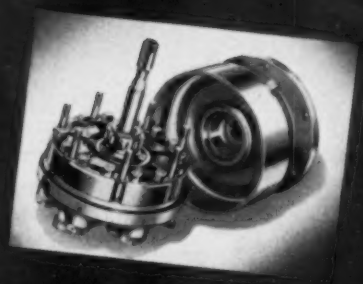

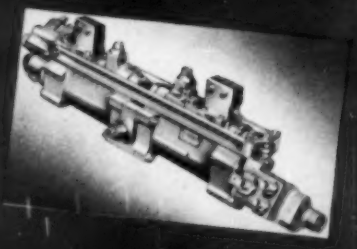

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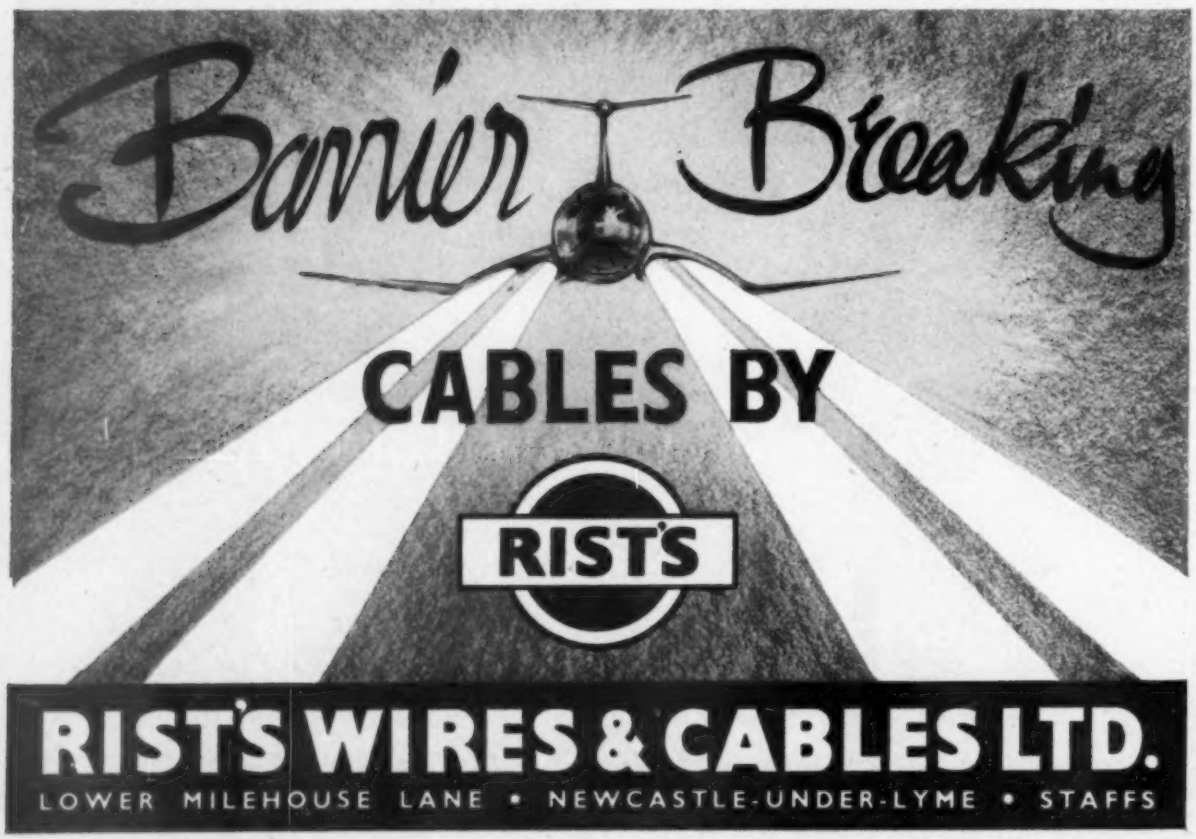

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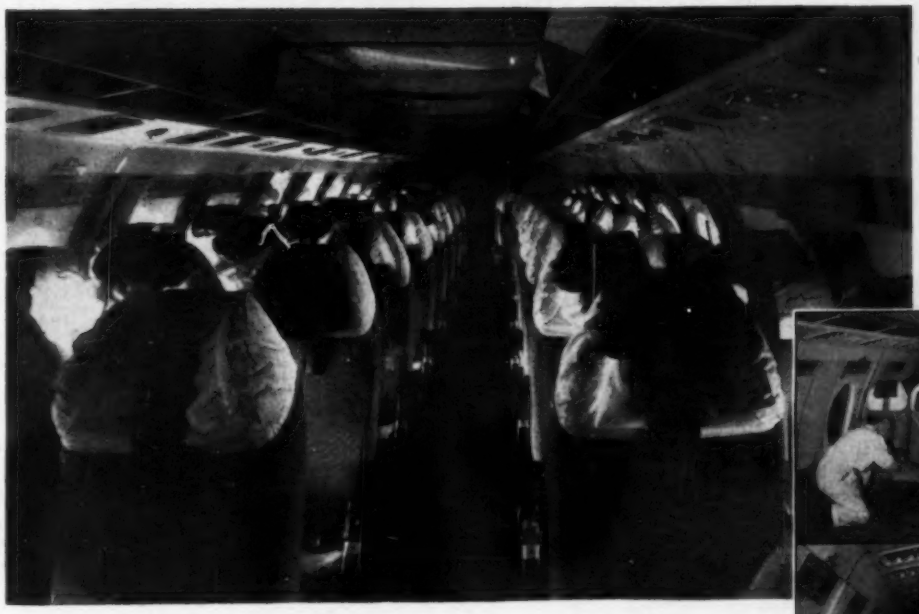

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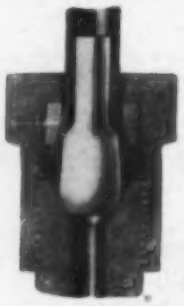

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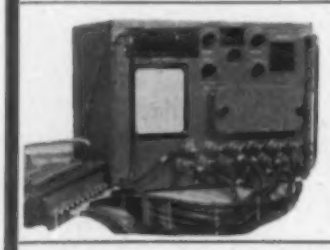

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This organisation aims to tell the real story of Britain's achievements, to claim for the British people and for British industry the credit that is theirs: and by doing so to reinforce Britain's prestige throughout the world to the benefit of our trade and our standard of living.

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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

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The Rapier—

THERE is no unanimity that the Chief of the Air Staff was either ethically or technically justified in publicly declaring, as he did at Sheffield the other day, that we could destroy Russia tomorrow, and that the Russians would be unable to retaliate. But his contentions that the British deterrent is by no means as small a part of the whole as its size might imply, and that our V-bombers fly higher and faster than "their American counterpart," command unqualified acknowledgement.

The V-force, as rounded out by the enrolment of the Victor on the order of battle (*Flight* last week), is the "rapier" envisaged years ago, by a former A.O.C-in-C. Bomber Command, as the successor to the piston-engined "bludgeon." As those years have passed there has been desultory criticism of the decisions which allowed all three of our great bomber-builders, Vickers-Armstrongs, Avro and Handley Page, to keep their hand in at their traditional trade—the trade that won them fame and fortune and gave the R.A.F. the Wellington, the Lancaster and the Halifax. Today those decisions are seen down the perspective of years to have been as wise as they were courageous.

There are three main reasons why Britain's bombers are superior to those of other Powers: there is something rather special about their aerodynamic design; they are moderate in wing loading and power loading; and their turbojets are uncommonly efficient in terms of thrust and consumption at altitude. The high speed and lofty operational ceiling thus conferred has fully vindicated another portentous Air Staff decision—to abandon defensive armament; and the flexibility of the basic designs is permitting wide adaptation to changing requirements.

—and the Steel

It was the exponent of the "rapier"—Sir Hugh Pughe Lloyd—who championed also the stand-off bomb ("We *must* get away from these free-falling bombs," he insisted). Thus it came about that the steel for the rapier was of a very special kind—Blue Steel, in fact (for that, we are assured by our friends on *Aviation Week*, was the code name of the Avro air-launched rocket-propelled guided bomb publicly introduced the other week at Farnborough). This bomb is the weapon whereby the high-subsonic Vulcans and Victors will greatly increase the force and accuracy of their rapier thrust while diminishing their own vulnerability; and its introduction will be as significant as would have been the adoption of a bomber with a supersonic "dash" performance. This is not to affirm that the R.A.F.'s interest in a supersonic bomber has lapsed. The aeroplane demanded, however, is a Canberra replacement in the tactical field, and not a successor to the strategic Vulcan and Victor. It is nevertheless worth speculating that with its unprecedented operational flexibility (and eventually with VTO characteristics) such an aircraft might render a formidable account of itself as a strategic weapon also, for strategy and tactics will increasingly be intermixed by shifting political pressures.

It is this same commingling of strategic and tactical demands that calls for a word about the recent amazing behaviour at Farnborough of the Vulcan and Victor. The LABS, or toss-bombing, manoeuvre (half a loop and roll-out) is a safety measure which allows the attacking aircraft to get clear of the atomic explosion it has caused; and certainly it is difficult to reconcile with the delivery of a stand-off bomb having a range of 400 miles. In dismissing the manoeuvre as a "circus trick," however, G/C. "Johnnie" Johnson, station commander at Cottesmore, where our first operational Victors are based, may have done less than justice to the planners, designers and test pilots concerned. The LABS delivery is standard procedure for hundreds of Boeing B-47s in U.S.A.F. service, and in the event of Vulcans and Victors being called upon to deliver tactical A-bombs instead of supersonic unmanned H-bombers (for Blue Steel will be just that), the quick pull-up and roll-out will be a very neat little circus trick indeed for a V-bomber pilot to have up his sleeve.

FROM ALL QUARTERS

NA.39 Production Prospects

EARLY last week a production future for the Blackburn NA.39 was assured when the Ministry of Defence announced its intention of ordering long lead-time components and materials. Mr. Eric Turner, managing director of Blackburn and General Aircraft, stated that production plans—with the possibility of sub-contracts to Fairey—were ready, and that the type would enter service during 1961. The remainder of the pre-production batch of twenty would rapidly follow the two machines now flying and some of them could form the first squadron.

This firm support, he said, would greatly assist efforts to sell the NA.39 to such countries as Germany. Though the U.S. Navy had shown interest, no positive action had resulted. Nevertheless, since the S.B.A.C. Show an unnamed American company had displayed interest in possible licence production.

Mr. Turner added that an "unnavalized" version had been offered to the R.A.F. in response to O.R.339. Blackburn believed that the NA.39 formula was the right one for the strike rôle and that it was fully three years ahead of any other project in the world. Realization of a true O.R.339 machine was probably some seven years distant.

The cost of an NA.39 is likely to be very considerably less than the £800,000 suggested by some reports. Mr. Turner said that the cost of a batch of 50 and the 20 pre-production machines and their development might be in the region of £40m.

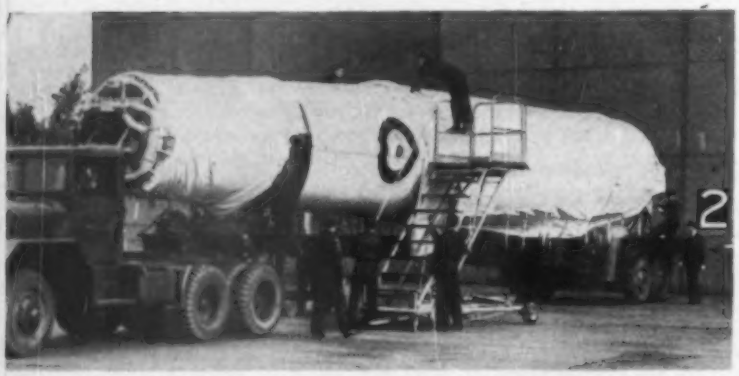
First Thor Delivered to R.A.F.

LAST Friday the first Thor IRBM, a non-operational training round, was officially handed over to No. 77 Strategic Missile Squadron of R.A.F. Bomber Command at a launching base near Feltwell, Norfolk. It had been flown from America to Lakenheath in a C-124 Globemaster and was driven to the site on its articulated transporter vehicle.

On reaching the firing site, the Thor trailer is linked to a six-legged steel pad structure, which is then rotated and fastened to the missile. Towing vehicle and independently steered rear bogie are removed and the assembly remains horizontal under a rail-mounted shelter. It can be kept fully ready in the emplacement and, shortly before firing, the shelter is rolled clear and the trailer, missile and an umbilical mast are rotated into the vertical firing position by a hydraulic power unit attached to the pad. Concrete blast-walls protect various servicing trolleys, while fuelling trailers are located on each side at a little distance. All ancillary units and the pads themselves are readily fitted with road wheels.

No. 77 Sqn. is not yet at full strength and U.S.A.F. personnel under the command of Col. W. Delahay are attached to assist in training and, it is reported, to maintain nuclear warheads. The latter may now also be produced in Great Britain.

Thor development history was recorded in *Flight* for December 6 last year and a picture of a completed Thor firing site appeared on February 7.



ONE OF TWO Sud Alouette 2 turbine-powered helicopters on arrival at Eastleigh, on Thursday of last week, for evaluation trials with the Army. The Alouette 2 is competitive with the new Saunders-Roe P.531.

B.O.A.C.'s Comet 4 Plans

WHEN Pan American announced two weeks ago that the first transatlantic Boeing 707 jet services would start on October 26, there was speculation that B.O.A.C.—whose target-date for the introduction of Comet 4 services was "before the beginning of December"—might bring their date forward. Last Tuesday there seemed good reason to believe that B.O.A.C. may indeed be the first airline across the Atlantic with jets. Comet 4 deliveries and training were likely to be ahead of schedule.

Prospects for the EP.9

THERE is a probability that Edgar Percival Aircraft, Ltd., will be taken over by Samlesbury Engineering, Ltd., of Blackburn, Lancs.

Edgar Percival Aircraft has been in financial difficulties for some time, and last July a compulsory winding-up order was made against the company on a petition by the Finance Corporation for Industry. The latest records for Edgar Percival Aircraft (in which the F.C.I. is the major shareholder) disclosed unsecured liabilities of about £400,000 as against assets valued at approximately £100,000.

It is understood that the Samlesbury offer is welcomed by the F.C.I. as a means of allowing design and construction of the EP.9 to continue without further financial demands on the Corporation.

Conway-Vulcan Accident

DURING the Battle of Britain "at home" at R.A.F. Syerston on September 20 the Conway-Vulcan test-bed crashed while making a low pass (a wing breakage was reported), killing the crew of four and three R.A.F. airmen on the ground. The aircraft, which was on loan to Rolls-Royce, Ltd., from the Ministry of Supply for engine development work, was being flown by a Rolls-Royce test pilot, K. R. Sturt. With him as co-pilot was R. W. (John) Ford, one of Fairey Aviation's two test pilots at

THOR POINTS: Awaiting completion of its launching site elsewhere, the first Thor for the R.A.F., minus nose-cone, rests on its transporter, the rear bogie of which is independently steered and detachable. Below left is the movable hangar which will cover Thor as it lies at readiness in a horizontal position. The six-armed launching pad, seen in detail below, is fastened to the missile and the whole assembly is then rotated into the vertical firing attitude by the mighty hydraulic ram fixture on the right. This is in fact bolted to the launching site, although it can be towed on its "undercarriage."

"Flight" photographs

SQUATTERS: Jim Heth and Bill Burkhart, seen replenishing their Cessna's stores above, landed on September 21 after spending 50 days airborne (further details in news-item below).

VIGILANTE, North American's A3J carrier-based supersonic bomber (two General Electric J79) is seen airborne at upper right with its "chase ship." The A3J was described in our issue of May 30 last.

SEAMASTER, Martin's P6M four-jet flying-boat, seen (right) on its beaching vehicle, steering and braking of which are pilot-controlled.

Ringway, who was seconded to Rolls-Royce. The two other crew members were W. E. Hopkins (engineer-observer) and F/L. R. M. Parrott (navigator). The R.A.F. men killed were Sgts. E. D. Simpson and C. Hanson, who were in the control caravan, and S. A/C. J. J. Tonks, who was manning a fire service vehicle. Another airman, S. A/C. C. Turnbull, was injured.

Endurance, Mechanical and Human

TWO pilots landed at Dallas, Texas, on September 21 in their Cessna 172 after having taken off on August 2. The pilots, Jim Heth and Bill Burkhart, had thus spent 50 days in the air compared with the present world endurance record for light aircraft of 47 days.

The Cessna was refuelled twice daily by attaching fuel containers to a rope which was lowered on to a lorry speeding down the runway. The containers were then pulled up into the aircraft cabin and the fuel poured into the large auxiliary tank.

Martin-Baker Ejection Seats

SAFE ground-level ejection is a feature pioneered by Martin-Baker and one which has for some time been standard in several versions of their seat. In these pages recently it was stated that a seat in the Canberra allowed a minimum safe ejection height of 600ft, but this is peculiar to earlier Canberras with modified Mk 1 seats. In ground-level seats the decelerating drogues deploy ½ sec after ejection. If the airspeed is too high to allow safe deployment of the main canopy an automatic device delays the sequence. The personal-equipment connector, illustrated in our report, was developed and patented as a private venture by Martin-Baker; it is now in service in both R.A.F. and F.A.A. aircraft.

Westland Appointment

IT is announced that Captain W. B. Axford, O.B.E., R.N.(Rtd.) has been appointed chief development engineer at Westland Aircraft, on the staff of Mr. O. L. L. Fitzwilliams, B.A., chief engineer. He will be in charge of flight and operation engineering requirements.

Entering the Royal Navy in 1926, Capt. Axford had a distinguished career in the Engineering Branch. In 1938 he went to Henlow as one of the first three Naval engineer officers to undergo advanced training in aeronautical engineering at the R.A.F. Technical College. Passing out with credits in August 1939, he served in a series of Naval engineering/air appointments, including service in the carrier *Glorious*. In 1952 he was promoted captain and in June 1953 was appointed Assistant Director of Naval Aircraft Research and Development at the Ministry of Supply. During the last two years of his service with the Ministry he was primarily responsible for the development of helicopters for all three Services.

IN BRIEF

First overseas deployment of two new American weapons occurred earlier this month during the reinforcement of Taiwan (Formosa). The weapons are the U.S.A.F.'s Lockheed F-104A Starfighter air-superiority fighter and the U.S. Army's Nike Hercules long-range anti-aircraft missile.

* * *

On September 16 a Chance Vought Regulus II bombardment missile was fired from the submarine U.S.S. *Grayback* off Point Mugu, Cal; the missile burned when its recovery system failed at the end of its mission at Edwards A.F.B.

* * *

A Skylark research rocket was fired at Woomera on September 19, reaching a height of 95 miles. This was the fourth firing in the high altitude research programme arranged jointly between the Royal Society and the Ministry of Supply and forms part of Britain's contribution to the I.G.Y. programme.

* * *

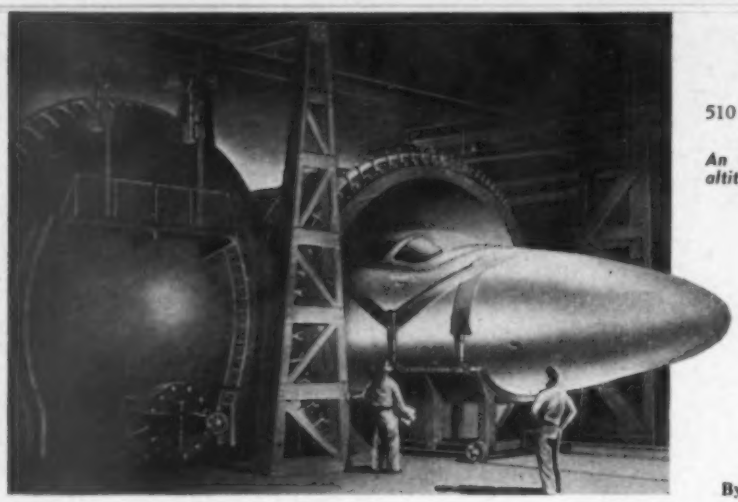
Eight Valiants of R.A.F. Bomber Command arrived at March A.F.B., Cal, on September 18 to take part in the U.S.A.F. Strategic Air Command bombing and navigation competition (see Service Aviation, page 536). The force is commanded by G/C. L. M. Hodges and the crews are to engage in 66 training sorties prior to the competition to familiarize themselves with its rules and procedures.

* * *

Guest of honour at this year's annual London dinner of the de Havilland Technical School Old Boys' Association will be Sir Alan Cobham who was closely linked with de Havilland in earlier days. The dinner will be at Simpson's-in-the-Strand, and will take place at 7 for 7.30 p.m., on Saturday, November 8. Tickets, price one guinea, may be obtained from the Secretary, D.H. Technical School Office, de Havilland Aircraft Company, Hatfield.

CAPTAIN W. B. AXFORD, who, as reported in col. 1, has been appointed chief development engineer, Westland Aircraft.

W/C. H. C. JOHNSON, whose appointment as commercial manager of Flight Refuelling, Ltd., we recorded last week.



An artist's impression of the new Normalair high-altitude/high-temperature decompression chamber described in the text.

A NEW NORMALAIR FACILITY

By E. W. STILL, Ph.D., A.M.I.Mech.E., F.R.Ae.S.*

High-Altitude High-Temperature Chamber

MUCH has been said during the past twelve months of the need for adequate development of the equipment used in modern aircraft. It is therefore of considerable interest to see how one of the aircraft companies is applying its experimental facilities to the testing and development of equipment required in new industrial fields. The laboratories of Normalair, Ltd., are of particular interest in this connection. The company has long specialized in the pressurization and air conditioning of military and civil aircraft and is able to establish most conditions of flight by testing the aircraft systems in altitude chambers, the air supply tapped from the aircraft jet engines being simulated by supplying air from large compressors, and the altitude conditions being provided by large vacuum pumps capable of giving altitudes up to approximately 100,000ft. With such development backing it is possible to offer cabin pressurization, flow control, temperature control, humidity control and oxygen breathing equipment exactly suited to the severe conditions that will be encountered in flight.

The current development programme of Normalair, in which their resources of power are being applied to full-scale heat transfer experiments on nuclear reactor components, illustrates how existing development facilities can be turned to immediate use in the nuclear energy and other fields. Another specific illustration of the potential of such a laboratory is demonstrated by the latest Normalair altitude chamber, in which full-scale testing of aircraft and missile cooling systems can be carried out. In this chamber it is possible to simulate the effect of the increase of ram air temperature at high Mach numbers on aircraft and missile skins, and at the same time to operate and prove the internal cooling systems to ensure that personnel or radar and radar equipment are unaffected by the extreme external heat loads applied at such speeds.

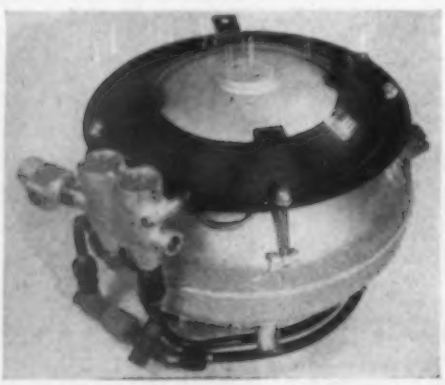
The high-altitude high-temperature chamber—the largest of its kind in Europe—has a volume of 7,500 cu ft, and is 42ft long, with a clear internal diameter of 15ft. It can be supplied with air at flows up to 335 lb/min and pressures up to 230lb/sq in gauge. The temperatures of the supply air vary from +2 deg C to 550 deg C, with ability to establish static ambient chamber conditions down to −45 deg C. In addition, the chamber can be fitted with infra-red heating to simulate the aircraft skin conditions encountered at speeds up to three times that of sound; a process calling for 300 kW of electrical energy. It is also possible to provide altitude chamber air flows as high as 60 lb/min at an upstream altitude of 60,000ft, a maximum rarified air flow of 440 lb/min being possible against an upstream altitude of some 25,000ft. It is obvious that to provide such facilities a very large compressor and exhauster power house are required, some 4,000 h.p. being available.

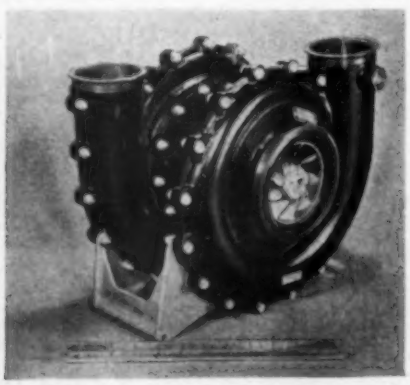
The laboratory is equipped with a selection of other altitude chambers with volumes ranging from 3,000 cu ft to 450 cu ft, together with the necessary power backing, instrumentation and subsidiary equipment necessary to allow Normalair first to develop thoroughly, and finally test, all the systems covered by the broad heading of aircraft air-conditioning. Such a wide field of activity implies that there exist full facilities for testing heat exchangers and for the manufacture and development of all forms of refrigeration equipment, both of the air-turbine air-cycle type and the closed circuit vapour-cycle type such as is used in industrial refrigeration.

It has always been necessary in the aircraft industry to prove equipment under conditions of vibration, acceleration, climatic and ambient temperature variation, pressure (both positive and negative) and contamination by dust, bacteria or other foreign matter. Normalair therefore possess vibration rigs of all kinds: climatic cabinets for testing from −85 deg C to 120 deg C (with 100 per cent humidity); acceleration rigs providing up to 26g; pneumatic and hydraulic pressure sources up to 4,000 and 10,000 lb/sq in gauge respectively; high-vacuum rigs down to a nominal 10^{-9} mm Hg; fungus-growth cabinets; methelyne blue particulate testers; whirl rigs capable of assessing rotating parts up to 110,000 r.p.m.; and special leak testing and out-gassing test equipment.

Military oxygen work, and the experience gained on breathing equipment for climbing, has been of value in the industrial fields of fire-fighting, diving and the countering of air contamination, as well as in the medical or therapy fields. The military programme has led to the solution of the many problems concerned with the development of liquid oxygen converters, and as a result the company has amassed a considerable background of technique in the production of high-vacuum containers for liquid gas and other purposes. This again has application to other industrial fields.

Technical Director, Normalair, Ltd.





At left, 3½-litre stainless-steel liquid oxygen converter. Centre, 75 lb/min cooling turbine. Below, 10 lb/min cooling turbine.

Discussing Space-Law

POINTS FROM THE SPEECHES AT THE HAGUE SPACE-LAW COLLOQUIUM

IN conjunction with the Ninth Congress of the International Astronautical Federation (see *Flight*, September 5 and 12), a Colloquium on Space Law was held in the House of Parliament at The Hague on August 29, attended by distinguished lawyers and jurists from many parts of the world.

Chairman of the colloquium was Andrew G. Haley, the eminent U.S. legal authority. He opened the proceedings by stating that the I.A.F. Committee on Space Law, meeting in Amsterdam, had suggested a number of points as requiring urgent attention. These were: (a) upper limit of effectiveness of present air law; (b) upper limit of national sovereignty; (c) radio frequency rules affecting artificial satellites and other space-vehicles; (d) rules governing the re-entry of falling satellites; (e) rules affecting the operation of satellites for weather observation, radio and TV relays, and other public services; (f) quasi-military functions (e.g., reconnaissance satellites); (g) military conventions; (h) contamination of extra-terrestrial bodies; (i) rules of discovery and occupancy affecting extra-terrestrial bodies; and (j) deleterious effects caused by as yet unknown physical phenomena and techniques.

Scientists were already thinking of mounting TV cameras in satellites for the purpose of obtaining an overall picture of the earth's cloud cover and other meteorological phenomena (e.g., the movements of storm centres). Although this held promise of revolutionizing the science of weather forecasting, such vehicles could be used to map foreign territories and carry out certain reconnaissance duties. This directly raised the question of national sovereignty, for despite the fact that no objection had been raised to the passage of I.G.Y. satellites over sovereign States, the situation would be markedly different if these vehicles carried reconnaissance equipment or were acting as bomb-carriers.

In view of the belt of intense radiation that had recently been discovered to exist in the region of the Earth's magnetic field, the construction of large space-stations as envisaged by Dr. Wernher von Braun and others as "invulnerable bombing platforms" might never be practicable, and the more immediate threat appeared to lie in "satelloid" aircraft (e.g., the Dyna-Soar project) which could be sent into close-satellite orbits and recovered at will.

Then there was the problem of the Moon, for now that the first lunar probes were being launched it was important to ensure that no deliberate attempts were made to impact the Moon's surface with space-projectiles, as had been suggested at last year's I.A.F. Congress by Prof. S. F. Singer. [It will be recalled that Prof. Singer suggested firing an atomic-tipped missile at the Moon to blast a section of the crust into space for scientific observation of the debris from Earth.] Any experiment which might carry radioactivity or earthly bacteria to the Moon might seriously prejudice the value of future exploration.

Under "rules of discovery and occupancy of extra-terrestrial bodies," there was the question of ensuring that the Moon did not fall under the control of any one nation who, at some future time, might wish to exploit it as a military base.

National Sovereignty

These and other matters were taken up in detail by the lawyers present at the colloquium, most attention being paid to the question of national jurisdiction affecting the boundaries of air law. Many speakers thought the boundary should be fixed at the height at which vehicles could no longer be supported by aerodynamic means. It was emphasized that sovereignty based on the space above any particular country would be meaningless, as each country is part of a revolving Earth and any given region of "space" is not fixed above it. "The sovereignty of the State has two main characteristics," said Dr. M. Smirnoff (Yugoslavia). "One is the fact that sovereignty must be real in the sense that it can be defended by the State which claims it. The other characteristic is that, if the claim is to be based on a fact, one must know exactly where this fact occurred. Neither of these characteristics can be found in outer space. First of all, in terms of contemporary technological development, no State can defend its right of sovereignty at an altitude of 2,000 miles, for example. Furthermore, it is impossible so to locate an occurrence 2,000 miles in space that one could say that it took place in the sovereign regions of Belgium or of neighbouring Holland."

On the subject of artificial satellites, much discussion ensued over the liability of the launching nation for any damage that might be caused should these vehicles or their carriers crash on other territories. One speaker suggested that, as present satellites, once launched, were uncontrolled and subject only to the laws of celestial mechanics, they should be treated as "meteorites" and any resulting damage should be regarded as an act of God. This was not the general view, and the feeling of the meeting was that the liability should be placed squarely at the feet of the launching nation.

To meet this problem, Dr. I. H. Ph. de Rode-Verschoor (Netherlands) offered three suggestions: (1) The State that launched the space-vehicle could accept full responsibility for possible damage; (2) that State might be entitled to make certain reservations, excluding, for example, responsibility in the case of *force majeure* (e.g., on unforeseen collision with a meteorite); (3) one might consider the inauguration of an international guarantee fund to pay for any damage caused by space-vehicles.

Further comment was provided by Mrs. Eilene Galloway (special consultant to the Committee on Space and Astronautics of the U.S. Senate). "If anti-missile missiles are developed so that a satellite can be destroyed in orbit," she said, "this fact will provide a penalty for satellites which are deemed hostile in intent. If satellites always burned up before they reached the Earth we would not have the legal problem of responsibility for damage; but we have had sufficient evidence that a solution is on the way, and the extent to which scientists can control the re-entry of missiles and satellites will determine the substance of national and international law on this matter."

Congressman James Fulton, a member of the U.S. National Aeronautics and Space Council, asked the meeting to consider the effect on morale of an armed satellite circling the Earth with pre-planned re-entry characteristics. He and other speakers raised the desirability of space experiments being conducted under the control of some international authority; but since any infringement might lead to the shooting down of satellites not launched under proper auspices, it was questionable whether, by breaking them up into smaller fragments, this would not in itself constitute a hazard.

With satellite techniques improving all the time and vehicles like the Vanguard test-satellite incorporating radios powered by solar batteries, wave-bands of the radio spectrum may be jammed one after the other. It is vital, therefore, at the earliest possible time to standardize the radio frequencies used in astronautics. To this end, Mr. Haley, on behalf of the I.A.F., had in May attended the Moscow session of Working Group XI of the International Radio Consultative Committee to discuss general problems of the use of radio and television in astronautics. At the twelve-day meeting, it was decided that the questions, problems, and study proposals which were submitted to the Plenary Session by Mr. Haley could better be acted upon by Study Groups V and VI, and the Director of the C.C.I.R. proposed a programme which would be studied by the Consultative Committee.

It was decided that the following questions should be studied: (1) what frequencies are specially suitable for penetration of the layers of the Earth's atmosphere; (2) what are the influences on these frequencies of the hour of the day, the season, the geographical location and solar activity; (3) what deviations in propagation direction can be expected by the penetration of the ionosphere; (4) what, if any, will be the differences in propagation between in-going and out-going signals relative to Earth; (5) are special phenomena to be expected that do not occur in transmission between two points on Earth; and (6) what is the possible influence of the troposphere on wave propagation to and from extra-terrestrial objects?

Mr. Haley reported to the colloquium that it was proposed the C.C.I.R. study and modify or confirm these needs for the astronautical services and invite the I.F.R.B. to make the appropriate frequency allocation proposals for consideration by the Administrative Radio Conference convening in August next year.

Opportunities for Action

It is not possible to give more than a brief summary of the many other issues raised at the colloquium, the purpose of which was to give lawyers of many nations a chance to air their views and recommend further action rather than to start formulating actual laws. However, the meeting attracted a good deal of outside interest. One speaker, himself an engineer, made the point that scientists and engineers shared an equal responsibility with the law-makers and should play their part in helping to shape the social sciences, which at present were lagging so badly. In astronautical development, he said, we had a unique opportunity, for we could already see the shape of future events emerging in this fast-growing science and had the opportunity of planning certain rules of conduct accordingly before the events themselves occurred. Needless to say, we could not at this stage consider enforcement of a law of outer space, but we could, and should, draw attention to the need for an international code of behaviour both in the interests of humanity and in the future of scientific exploration; this should be discussed at the highest international level. Mr. George Feldon agreed that not enough was known about outer space to work out a law, but that did not mean there could not be interim agreements. But, he warned, we should not enter into international agreements that were not warranted by our present knowledge.

"A beginning programme," said Mrs. Galloway, "would undoubtedly include a survey of available resources: of the international and national organizations now working on problems of space science and law; of outstanding individuals who are contributing ideas to professional journals and various committees; of existing treaties and conventions; and of the relationship of the effort to the International Civil Aviation Organization and the United Nations."

* * * *

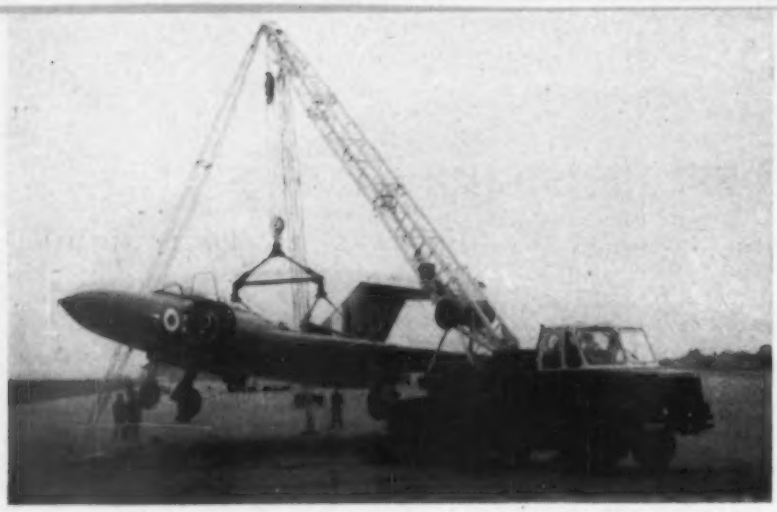
That the United Nations was the correct forum for discussions of this kind was the unanimous view of those present at the colloquium, although it was recognized that organizations such as the International Astronautical Federation could do much to promote interest, evaluate the various problems and give technical advice. Accordingly, the following resolution was unanimously approved by the colloquium, and subsequently adopted by the I.A.F. Council:—

(1) That the legal problems involved by the development of astronautics be settled through a new international Convention.

(2) That within the framework of the I.A.F. be created a Legal Permanent Committee, open to lawyers of the various Societies and groups affiliated to the Federation, and whose members be entrusted with the study of all the problems of the law of space to be included in the Convention mentioned in Resolution 1.

(3) That the above resolutions be communicated to the Secretary-General of the United Nations, who should be assured of the desire of the I.A.F. to co-operate in any initiative to be taken in the field of astronautics by the United Nations.

KENNETH W. GATLAND, F.R.A.S.



***HIGH LIFT COEFFICIENT:** The new KL10-10 "Fast Travel" mobile crane made by K. and L. Steel Founders and Engineers, Ltd., makes light work of a Javelin. Note that there is room for a loader transport to be driven under the aircraft.*

HERE AND THERE

Up—

IT was announced by Mr. Athol Townley, Australian Minister of Supply, on September 18 that Australia had successfully fired her own two-stage rocket, Long Tom, only ten weeks after deciding to make it. He said that the rocket, capable of reaching a height of 120 miles with a 10 lb payload, was adapted from four standard British types. It was first fired last year and there had been five subsequent launchings at Woomera.

—and Down

A DEVELOPMENT Atlas ICBM blew up at Cape Canaveral on September 18 after reaching a height of 50,000ft after 90 seconds' flight. This followed a successful half-range firing four days earlier.

Airborne Weather Stations

UNDER a U.S.A.F. contract, worth $11m in the first year, Bendix Aviation Corporation is to work on a system for the use of jet aircraft as flying weather stations. The first aircraft for this purpose is expected to go into operation within the next twelve months.

Commonwealth Tour

THE chairman of the Commonwealth Advisory Aeronautical Research Council, Mr. J. H. Parkin, is at present making a tour of the council's member-countries. This is the first occasion on which a chairman of the C.A.A.R.C. has made such a journey. Mr. Parkin, until last year director of the National Aeronautical Establishment at Ottawa, is expected in this country at the beginning of next month.

Scottish Cut-back

REDUNDANCIES are expected at the three Rolls-Royce factories in Scotland following a drop in orders. A spokesman said that these redundancies would be "comparatively small" in relation to the total number of 11,000 employees. The fall in orders was mainly owing to Government cuts in the military aircraft programme and the decreasing use of piston engines in B.O.A.C. Argonauts.

Air Law Courses

EVENING lectures on international and comparative air law are again being held this coming session by University College, London. The first-year course, dealing with general principles, will be on Tuesdays beginning October 7, and the second-year course (covering selected problems at a more advanced level) on Wednesdays beginning October 8. Further details are available from the Clerk to the Faculty of Laws, University College, Gower Street, London, W.C.1.

Peaceful Missions

FLYING on overseas missionary duties is described in a film called *Of Wings and Missions* which is being shown by the B.B.C. in the television programme *Meeting Point* next Sunday (September 28) at 7 p.m. This film has been made by the Missionary Aviation Fellowship, which operates 20 aircraft—mostly Cessna 180s, either on wheels or floats—in nine different countries.

Keeping Industry Moving

SPECIAL issues dealing with this year's Commercial Motor Transport Show at Earls Court are being published by our associated journal *Motor Transport*. Out today (September 26) is the Show Report number, giving a stand-by-stand survey, and the Show Review issue next Friday (October 3) will contain a complete review of exhibits and technical and design trends at the Show. The price will be 6d as usual.

Dutch A.A. Missiles

IT was announced in the Dutch Parliament on September 18 (by the Defence Minister, Mr. Cornelis Staf) that the U.S. would shortly offer the Netherlands Government complete guided missile equipment worth 120m guilders (about £12m sterling) for the two cruisers *De Ruyter* and *De Zeven Provincien*. Mr. Staf said the missiles were for use against aircraft and had been made necessary by modern attack techniques.

W/C. H. F. Jenkins

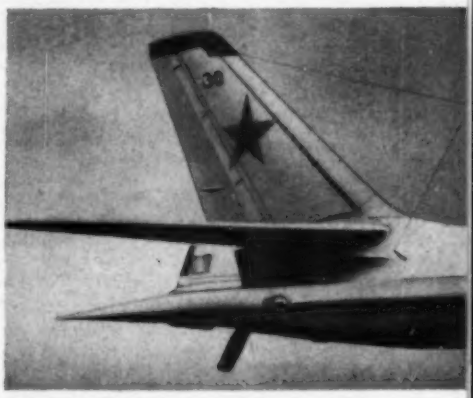
WE record with regret that W/C. H. F. Jenkins, O.B.E., A.F.C., who was director of training at A.S.T. from 1949 until his retirement in 1953 owing to ill-health, died recently at the age of 61.

V.H.F. Contract

A CONTRACT has recently been awarded by the U.S.A.F. to British Communications Corporation, Ltd., for the installation and maintenance of a series of comprehensive mobile V.H.F. schemes covering U.S.A.F. bases in Eastern England.

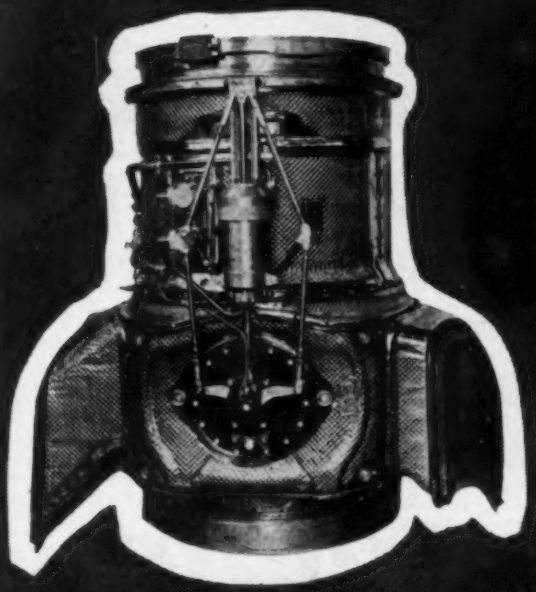
Cranfield Open Days

LABORATORIES, wind tunnels and other facilities of the College of Aeronautics, Cranfield, will be available for inspection by members of the general public from 11 a.m. to 6 p.m. on Saturday, October 11, when the College is holding an Open Day. On the previous day the College will be open to invited guests.



***STRANGE TAIL** observed on a "Badger" twin-jet bomber of the Soviet Air Force. Air-to-air refuelling may be the explanation.*

***LOST TAIL** of the Whirlwind in which Air Marshal the Earl of Bandon, C-in-C. F.E.A.F., had a fortunate escape when its main rotor amputated the tail assembly after a "snatch" start at R.A.F. Changi, Singapore.*



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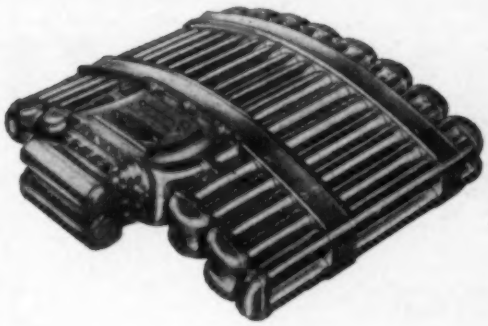
High pressure fuel-cooled oil coolers for high performance gas turbine engines. This unit is used in the Armstrong Siddeley Sapphire S.A.7.



Heat exchangers for many purposes in both aluminium alloy and stainless steel. This particular example is for the Vickers Vanguard's anti-icing system. Similar units are being supplied for the Fokker Friendship, the Bristol Britannia, the Armstrong Whitworth Freightliner, the Vickers Viscount and the Handley Page Herald.

We shall be delighted to help you with your problems in any of these fields

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£250,000 Trainer for Comet Men

By Our Air Correspondent

TO enable it to deal with the enormous task of training 130 crews to fly the 19 Comet IV jet airliners which it has ordered from de Havilland, B.O.A.C. is buying a ground simulator which will reproduce every condition of flight, even the gentle cockpit noise from the Comet's four Avon engines.

The simulator is being built by Redifon Ltd., specialists in this work, and it is hoped that it will be in operation in the early spring.

It will cost about £250,000—about the same as the simulator used to train Britannia crews—but it will save money by freeing Comets to carry passengers, not training crews. It will also be used for checking experienced pilots at appropriate intervals.

The electronics, which operate the simulator, occupy a sizeable room. They can reproduce any desired set of circumstances in the imitation flight deck from the effect of a power loss on take-off to that of a high-speed stall.

The flight deck will be a replica of that in the Comet IV, and will be in use day and night except for maintenance periods.

The men who are trained in the simulator will eventually fly the superb new aircraft not only across the Atlantic but also to Australia, South Africa and the Far East.

Extract from "The Observer" August 31st, 1958.

158R

Pioneering in Africa

The chief cameraman and production manager arrive on the rough airstrip at Maroua in the French Cameroons.

STOL AIRCRAFT ON A FILM ASSIGNMENT

By KEITH E. SISSONS

A PRESTWICK PIONEER recently returned to this country from French Equatorial Africa where, on charter from Film Aviation Services, Ltd., it had been on location for about three months in connection with a new Twentieth Century-Fox production, *The Roots of Heaven*. The unusual location necessitated the use of an aircraft with the ability to operate in the bush, having a reasonable range, and requiring little maintenance. The film is concerned largely with elephants, and an aircraft was considered to be most useful in searching out herds of these animals. Initially the helicopter had seemed to be the answer, but its comparatively poor payload in high ambient temperatures, and its short range, plus the limited maintenance facilities available, indicated that a STOL aeroplane—even with its disadvantage of requiring prepared strips—would be better.

The Prestwick Pioneer appeared ideal, and G-AODZ was accordingly chartered from Scottish Aviation, Ltd., by Film Aviation Services. It left Prestwick on January 31 this year, bound for Fort Archambault.

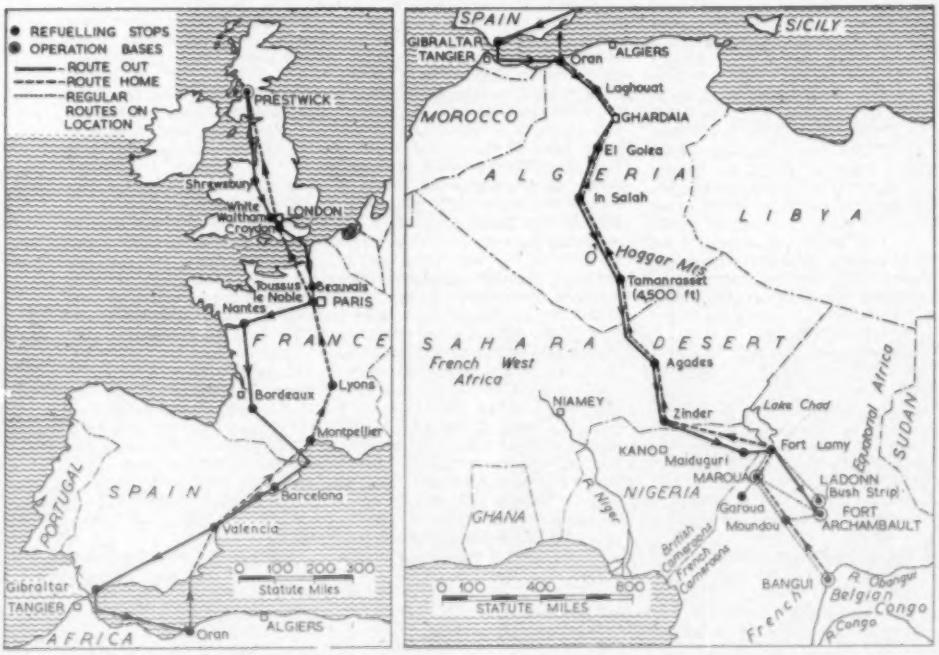
After many delays in Europe due to weather, Gibraltar was reached on Feb. 7, and there Capt. Crewdson joined the original crew of two—the writer (pilot) and Leslie Hillman (engineer).

Our next stop was Oran, where we had to await permission from the French Authorities to cross the Sahara Desert. When this had been granted (clearance being given to follow the main surface route), and after the emergency equipment, drinking water, radio equipment, documents, etc., had been thoroughly checked, the aircraft was allowed to leave. Just over two hours later, after the first leg, we landed on the desert strip at Laghouat at dusk. There a curfew was in force because of the political trouble in Algeria, but despite the presence of military forces all appeared quiet and we took off early next day for El Golea. It was intended to make the journey through the desert in easy stages to avoid flying after mid-day because of extreme temperatures, and this leisurely progress proved to be a most interesting experience.

As there were few V.H./D.F. facilities *en route* and the aircraft had only V.H.F. and H.F. R/T and no A.D.F., navigation was necessarily of the old-fashioned map reading variety, eventually amounting to a track crawl along one of the only two major routes across the desert, as shown on the map. A refuelling stop was made at El Golea (which to our surprise had a very modern airport), then "Delta Zulu" traced the route over a large plateau and after two hours the track dropped a few hundred feet on to a huge plain of white sand. The edge of the plateau looked as if it had just crumbled away, leaving one or two odd hills isolated in the plain and making one feel that one would like to take a huge shovel and tidy it up. Some minutes later a dark green patch appeared ahead—the oasis of In Salah, and shortly afterwards we landed on the desert strip in the usual cloud of dust. We spent a pleasant evening here with some members of that fabulous society the French Foreign Legion.

Next day we took off for Tamanrasset, and this proved to be the most fascinating of the legs across the desert. The plain of reddish sand in which In Salah lies changed suddenly to mountainous country where huge piles of black rock burst through the flat sea of sand like volcanic islands in an ocean. Soon we reached the well-known Arak Gorges, where the great Trans-Sahara highway (by now no more than a cart track) weaved its lonely way through the grim black mountains. In an open area of sand among these mountains we sighted one of the large trucks which fairly regularly cross the desert with supplies for the isolated forts and outposts, leaving a comet-like trail of dust behind it. Four hours after take-off we landed 4,500ft up at Tamanrasset in the O'Hoggar. As the next leg to Agades was scheduled as a five-hour flight, with the risk of running into darkness, it was decided to night-stop at Tamanrasset.

An early start was intended for the next morning to enable Zinder to be reached by nightfall, but the fuel tanks syphoned during the night and the aircraft had to be topped up; then a further delay was caused by the priority arrival of a South African Viking. Eventually airborne at 9 a.m., we started to follow the "road" to Agades. The forecast winds gave a flight-plan of just over five hours, with a point of no return 30 min after the halfway mark. It was soon discovered that a camel track was being followed instead of the road, and course was altered until the correct track, marked by oil drums in the sand, was sighted. A vast area of white sand stretched from



The tracks of G-AODZ across Europe and Africa.

Assistant director, cameraman with crew and actor (on bonnet) move off to shoot elephant sequences near N'guimi.

At right, preparing for action on a set at Fort Archambault.

Pioneering in Africa . . .

horizon to horizon as for two hours the road was kept in sight. Then the tyre marks gradually became less discernible, with only an occasional oil drum giving an indication of the invisible road, until these too disappeared.

Navigation now became extremely problematical. Our maps, though the latest issued, were based on 1943 information. Eventually, after what seemed an interminably long period of following doubtful trails we spotted a small village which (some hurried plotting suggested) must lie on the route to Agades. It appeared to link with a water hole on the map and if this was correct another 30 minutes should bring Agades into view. Head-winds had been much stronger than forecast, and we were now about half an hour beyond our E.T.A. We decided to fly for a little more than this time and, if Agades could not be located, to return and land in open country near the village after calling Niamey radio. A desert landing in the Pioneer was not considered to be very hazardous.

From the village a rough track, which had at some time been used by vehicles, headed southward more or less on course. It continued along a dried-up river bed and after a few small dust storms had been encountered the weather cleared and the occasional shrubs thickened almost to scrub; but still the road bore little resemblance to that indicated on the map. With ten minutes to go, the H.F. radio was tuned in to Niamey area control (there were no R/T facilities at Agades), fuel checked and remaining endurance calculated to be 52 min. The road curved off to starboard; the map indicated port; but we decided to continue for a further five minutes and investigate some thick scrub ahead. Suddenly a few mud buildings appeared and then a fort with obvious signs of a European community. A minute later one or two white markers showed up in the sand—an airstrip. Agades at last!

Six hours after take-off Delta Zulu's tyres came to rest in the burning sand of Agades. A Frenchman greeted us with the unexpected words "Bonjour, where have you come from?" We asked each other, "What's the use of a flight plan?" Although we were an hour later than our E.T.A. the departure message had not been received.

Next morning, after waiting for two hours for dust haze to clear, we took off for Kano via Zinder, and within an hour the true desert lay behind. Because of extremely poor visibility—it was down to a few hundred yards at times—"desert navigation" was used and the track was followed all the way. On reaching Zinder we were instructed to land, as Kano was below V.M.C. limits; and it was not until mid-afternoon that we were permitted to leave for Maiduguri in Nigeria, where the first macadam road for 1,500 miles was sighted with interest. At Zinder three B-17 Fortresses were seen and it was learnt that they were being used for aerial survey work in connection with new maps of the area. In the light of our recent experiences we considered this a very good idea.

After a comfortable night at Maiduguri, and under British care for a change, we reached Fort Lamy by using our normal track-crawl technique and the system of "logicalized assumption" we had found essential because of the complete inaccuracy of maps. Fort Lamy, of course, is a major airport and it was pleasant to park the aircraft between two DC-4s, leaving it in the capable hands of Air France and Shell while we enjoyed an excellent meal at the cool and up-to-date restaurant.

An hour later Delta Zulu took off incongruously from a 1,500-yard runway and landed at Fort Archambault after an uneventful three-hour flight during which the country had changed from light scrub to fairly thick bush—in fact, elephant country. The flight out was certainly no record; it had taken us thirteen days and 50 flying hours for the journey, but it had been done comfortably and with no mechanical trouble whatsoever. The Pioneer was pushed into the Armée de l'Air hangar for a well-earned rest and check-over, while we made ourselves comfortable in the bamboo and straw huts provided at Zanuckville, the film company's camp.

During the next week or so the film unit made general preparations for "shooting" while awaiting the arrival of the producer, Darryl F. Zanuck; the director, John Huston; and, of course, the stars, Trevor Howard, Juliette Greco and Errol Flynn. At the same time the aircraft was given a complete check. To its credit there were no snags, although much sand was found in the air filter, oil cooler honeycomb, flap bearings and so forth.

Little flying was done initially, but we made one or two local photographic flights for publicity films for television and the Press, and the Pioneer immediately proved itself an admirable vehicle for the purpose, with its slow-flying characteristics and excellent view, especially with one door removed. One flight was made as a general reconnaissance of the area for elephants and within 50 miles we sighted three large herds of up to 70 animals. This gave the film unit considerable encouragement.

The Pioneer was also usefully employed to transport actors, company staff, cameras, film and urgent freight between Fort Archambault and the next main location, Maroua (in the French Cameroons) and Fort Lamy (the nearest large town), 300 miles distant. This saved considerable time, as air services were infrequent. Special permission has to be obtained from the controlling authorities at Brazzaville for all single-engine flights in French Africa and full emergency equipment has to be carried at all times, including sufficient water for crew and all passengers for two days, together with food supplies, smoke canisters, Very pistol, tropical medical kit and shot-gun with ammunition.

During the next three months the Pioneer was the only single-engined commercial aircraft regularly carrying passengers in this part of Africa. As there were few fuelling facilities each flight was usually started with main and overload tanks full (120 gallons); this, together with the emergency equipment, reduced the payload to two passengers and baggage.

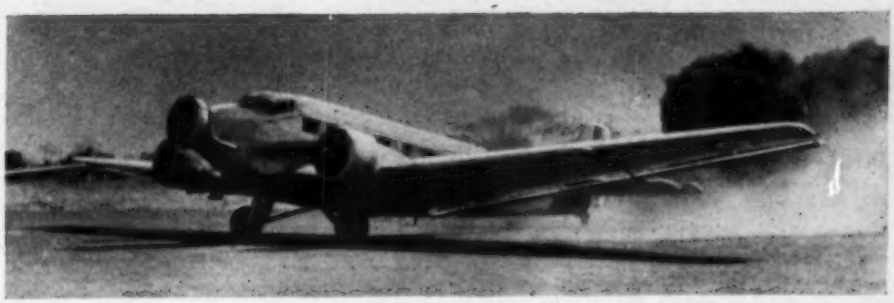
About ten days after our arrival Capt. Crewdson returned to England to begin work on another film with locations in Gibraltar and soon afterwards the stars, producer and director arrived and work began in earnest. The main unit with all its departments numbered approximately 100 people, but a number of these formed a second unit whose main task was to obtain many shots of wild elephants in the bush.

This second unit was composed of professional hunters as guides, plus camera crews, actor, sound operator, "grips" (those hardworking people who man-handle and manœuvre the various pieces of equipment) and a number of African labourers and mess boys. The party set off with four Land-Rovers for N'guimi, one of the gateways to the Sahara, 500 miles north of Fort Archambault, on the north shore of Lake Chad.

N'guimi is a typical desert town and appeared to be the most unlikely place to find elephants; nevertheless, there they were a few miles from the town, crashing through the low trees with their ears flapping and trunks probing the air, leaving their footprints like pot-holes in the sand.

Within two weeks the second unit returned to Fort Archambault to join the main party, who were shooting a major sequence of the film in that vicinity. Shortly afterwards a third unit was formed to obtain more shots of wild-elephant herds, and set up camp about 60 miles from Fort Archambault in the bush. After two or three weeks it became apparent that they were having difficulty in keeping track of the herds and had succeeded in exposing very little film, and presently a radio message arrived at Maroua asking if the Pioneer could be spared for a few days for elephant reconnaissance. A 260 m × 20 m strip, we were told, had been prepared. The aircraft was dispatched immediately, with engineer and equipment, for several days' operation. From the details given the strip was easily found, deep in the bush, but it looked smaller than we had expected. A successful landing was made, to the delight of the film unit. They told us that the strip had actually taken five men one day to prepare. Three trees had been felled, some light bushes cleared and the rough grass surface levelled by running a Land-Rover up and down it several times. The strip was re-measured and proved in fact to be 200 yd by 12 yd (180 m × 11 m), but with fairly good approaches.

After a brief council of war one door was removed and three



Still going strong: many of these Junkers Ju 52-3Ms are used by L'Armée de l'Air for transport in Africa.

professional hunters boarded the aircraft, but before we could take off it was necessary to wait several minutes for the dust to clear. Because of the many bush fires which occur in the area, the ground surface consisted largely of fine ash, and this produced a fantastic amount of dust when the engine was running. The Pioneer was airborne in less than half the take-off run available at maximum all-up weight of 5,800 lb (pilot, three passengers, five hours' fuel, and emergency equipment) and in a temperature of 44 deg C (I.S.A.+31), leaving a great black cloud of dust behind it almost worthy of an atomic explosion. On this first flight one herd was sighted within five minutes of take-off and another shortly afterwards. Their positions were noted and on landing the camera crew immediately departed to the area in their Land-Rovers.

The Pioneer continued to give similar assistance for the next two weeks, recce flights being made just after dawn and information passed to the film unit by H.F. radio, so saving time. In addition to the STR.9X V.H.F. the Pioneer was fitted with a Marconi AD.97 transmitter and receiver, and this H.F. set worked admirably throughout the three months' operation, no maintenance being required whatsoever. On very few occasions was the aircraft out of radio contact with either an airfield or one of the film units, even on long cross-country flights, and ranges of over 200 miles were obtained despite the short aerial length available.

The Pioneer also did its share of mercy work. On one occasion it was called from Maroua to a bush camp at Ladonn, 300 miles away, to remove to hospital a sick native guide suffering from blackwater fever. The man was too ill to travel the 60 miles to Fort Archambault, a day's journey by Land-Rover through the bush, and was liable to die within a few days. It was fortunate that the Pioneer strip had been prepared, for he was in a comfortable hospital bed within a few hours. A week later the aircraft was called in again to evacuate a six-year-old native girl who had injured herself seriously by falling on some broken glass; the film unit's doctor had done what he could, but an operation was necessary. For this little girl, who had probably never even ridden in a motor car, the half-hour flight was uneventful and she slept all the way.

About this time (mid-April) the film unit was air-lifted to Maroua by two Nord Noratlas (each was fitted with Turboméca turbojets at the wing tips in addition to its two Bristol Centaurus engines), a Heron operated by Union Aeromaritime Transport, and a DC-4 of Air France.

While at Maroua the Pioneer was used mainly for transporting passengers and freight between there and Fort Lamy, a hundred miles distant. In view of the Pioneer's exceptional landing and take-off performance special permission was given to use, instead of the normal airfield, an old overgrown airstrip near the town, normally open only to aircraft up to 2,000 kg in weight.

On completion of shooting at Maroua the film unit was again air-lifted to Bangui, which is in Southern French Equatorial Africa and divided from the Belgian Congo by the River Obangui. Here Delta Zulu was needed for a crash sequence in the film. Fortunately it was not necessary to "bend" the actual aircraft, as a dummy was provided for the final explosion and fire scenes. Conventional smoke canisters were used to give the effect of an engine fire and contact with the cameras was maintained by use of walkie-talkie radio—which, incidentally, gave excellent results even in the fully enclosed cabin. The required shot of the aircraft diving towards the ground at a fairly high rate of knots and disappearing behind some native huts with its engine apparently on fire will no doubt convince the public; but it is unlikely that a Prestwick Pioneer has ever crashed in these circumstances and it is equally unlikely that Scottish Aviation will therefore suffer any adverse publicity!

With one flight to Maroua to collect a wig for Juliette Greco's "double," the Pioneer's work with the film unit terminated. While the film personnel enjoyed a short and pleasant flight to Paris by DC-6B, Delta Zulu pointed her blunt nose northwards to begin the long return journey to Scotland. A week's delay occurred at Fort Lamy while awaiting permission from the French authorities in Paris to cross the desert again.

We reached the first refuelling stop, Zinder, on May 12 and a halt was called for the engineer who was suffering from heat fatigue. The next morning we entered the desert proper and landed at Agades for a further night's stop to avoid making the long flight to Tamanrasset in the heat of the day.

Before leaving early the next day I gleaned much useful information from the airport commandant regarding the latest route of the track. The flight-plan time was 5 hr 15 min and endurance at range speed seven hours. At it happened, the margin did not prove necessary; the track was lost to view on only two or three occasions for short periods, after which the occasional oil drum and marker pole reappeared. We night-stopped once more at Tamanrasset. After picketing the aircraft down and re-fuelling we were driven by Land-Rover to the village, where we took the opportunity of doing some sight-seeing. Tamanrasset was as eerie as we had thought it on the way out, being very quiet; the few people about, dressed in flowing white robes with their faces covered except for their eyes, moved as silently as ghosts as they made their way through the myriad narrow alleyways between the red mud walls of the village. Some of these people were Tauregs, most impressive in their traditional costume complete with long curved swords at their sides.

An early take-off was made next morning with the hope of reaching Oran but headwinds made this impossible. On leaving the mountains we were surprised to run into a rain shower associated with a depression in the area; but once more the lonely wilderness of desert stretched ahead, at the mercy of the sun beating down out of the vast blue heavens above. Once or twice we noticed the tents of a nomadic community of Arabs with their goats and camels, apparently living off sand. At one point we saw a camel caravan, looking like a set of toys placed head to tail on a great flat table—from the air they appeared to be standing still. After refuelling stops at In Salah and El Golea we landed for the night at Laghouat, having covered 1,000 miles of desert in 9½ hours.

Laghouat was now controlled by the military, as was much of Algeria, and the sight of Harvards (fitted with rockets and machine-

The continual battle with dust and heat: Leslie Hillman, engineer, at work on the Pioneer's powerplant. (Below, right) Action! A procession moves off to market. One of the scenes filmed at Fort Archambault, location-centre for the film.

Capt. Keith Sissons, the Pioneer's pilot on the assignment he describes in this article. (Right) Film colony: Zanuckville from the air.

Pioneering in Africa . . .

guns), barbed wire and armoured cars gave the impression there was a war on somewhere. However, all seemed quiet, though next morning it was impossible to leave early because of the 6 a.m. curfew; and the runway had to be swept for mines before we could take off. To our relief Delta Zulu was airborne without incident, Oran being reached in three hours. The blue Mediterranean was the most refreshing sight we had seen for some time.

Minor difficulties cropped up at Oran, firstly due to a brake snag during taxying-in, which necessitated parking the aircraft in the military area to change the brake disc. The Armée de l'Air were most helpful, however, and gave assistance to the engineer while the police authorities carried out an interrogation. At first the Pioneer was regarded with some suspicion, as we had no written authority for entering into the military zone of Algeria. While the brake repair was being carried out the police placed a guard on the aircraft, complete with Sten gun, with orders to accompany it to the Customs area when we were ready. We were further interrogated because the words "Film Aviation Services" on the fuselage apparently caused some concern, especially as the aircraft had taken two weeks to reach Oran after the completion of the film. The authorities thought that perhaps the time had been spent photographing military posts and oil rigs in the desert, and consequently all our personal undeveloped film was confiscated. However, the police carried out their orders in a friendly manner and when finally we were permitted to leave it was in an amicable atmosphere. By this time, however, it was late afternoon and although we obtained special permission to fly the 140 miles' direct sea crossing to the Spanish coast it was impossible to reach Barcelona as we had hoped, since the airport was closed by reason of winds of up to 66 kt. Therefore we landed on the flarepath at Valencia just after dark.

The next day, full of optimism, we took off with a golden vision of the Eiffel Tower before us; but on contacting Perpignan we learned that headwinds of up to 70 kt were forecast in the Rhône valley, so a night's stop was made at Montpellier. With better weather forecast the next day, Delta Zulu reached Paris via Lyons and, three days later after clearing Customs at Croydon, landed at its home airfield—Prestwick—little the worse for wear after its three months' sojourn in Africa.

During this time it had flown 250 hours, was serviced almost completely in the open and operated at maximum weight in consistently high temperatures up to 46 deg C. It had included among its passengers General Boislambert (ex-general of the French Army, and now in charge of the controlling authority for the hunting and game reserves in French Equatorial Africa); several well-known actors such as Errol Flynn, Paul Lucas and Marc Doenlitz; sick film-personnel; and one monkey. Its work ranged from elephant searches and mercy flights to collecting for Mr. Darryl Zanuck a special brand of cigars which had gone astray, as well as dispatching to Paris an urgent telegram regarding Juliette Greco's health, and collecting a vital supply of whisky when stocks had run out.

Apart from one major difficulty the aircraft operated in a remarkably trouble-free manner in the dry, dust-laden atmosphere. When it left Scotland no tropical filter was available and it was found necessary to clean air and petrol filters every day and remove the dust which clogged the oil cooler honeycomb almost as frequently. The continual battle with dust and heat gave Mr. Hillman, the engineer, little peace and it is to his credit that the aircraft did not miss one assignment. The only other difficulty found was in pushing Delta Zulu about by hand, as an aircraft of this size is not really designed for ground handling without tractor or towing arm.

The Pioneer was designed mainly to a military specification and has only recently seriously entered the civil field. This operation perhaps indicates the sort of competition the helicopter may expect from the STOL aircraft. It is interesting to note that it was Capt. Crewdson who advised the film company against the use of a helicopter in favour of the Pioneer, though his major work over the past few years has been with helicopters; and that on this operation the Pioneer was flown and maintained by pilots and engineer who had been almost entirely associated with helicopters for the previous four years.

THE WARREN-YOUNG PROJECT

MANY older readers of *Flight* will recall the Warren-Young Skycar, a tailless-aircraft project originally evolved in 1926. Mr. Norman Hall-Warren—who, with his partner, Mr. Rex Young, was engaged in developing the design in the years before the war—is still confident that the conception has wide possibilities. Preparations for the building of a full-scale aircraft were in hand when the war broke out.

Mr. Hall-Warren has sent us details of a power-driven flying scale model which, built recently by a Mr. G. Woolls, has made a number of successful flights.

The drawings recall that in plan view the Warren-Young aircraft was of a lozenge shape, resulting from the use of a forward swept-back wing and a rearward swept-forward wing, the two uniting at their tips; and the fuselage spanned the shorter dimension of the "flattened diamond" plan-form. The two planes forming the rear wing have wash-out towards their roots, which are at a lower level than the roots of the front wing.

The underlying theory is that the combined effect of the sweep-back and sweep-forward causes the boundary layer to move continuously outward from the centre-section of the front wing. It then follows a path around the tips and inwards along the rear wing, flowing away over its trailing edge near the rear centre-section. This characteristic maintains lift at extreme angles of attack. A slot effect also occurs near the junction between the front and rear wings, preventing premature separation of flow at the trailing edge of the front wing. An additional advantage claimed is that the wide chord at the wing-tip junctions spreads vortex-distribution, thus minimizing the tendency towards local stalling. The tip-stalling angle is, in fact, said to be beyond that attainable in flight, and may exceed 40 deg.

Further anti-stalling characteristics are conferred by the fact that the angle of attack of the rear wing is lower than that of the front wing, with the result that the former is still effective when the latter begins to fall.

SPACE-MEDICINE SYMPOSIUM

ORGANIZED by the British Interplanetary Society with the co-operation of the R.A.F. Institute of Aviation Medicine, the first British symposium on space medicine is to be held at B.M.A. House, Tavistock Square, London, W.C.1, on October 16-17. The meeting is intended for medical research workers, aircraft and equipment designers, and scientists. In conjunction with this event, the B.I.S. is holding a dinner at the Waldorf Hotel on October 17 to celebrate the 25th anniversary of the foundation of the Society.

A.V-M. H. MACKWORTH

WE regret to record that A.V-M. Philip H. Mackworth, who in the inter-war years was a specialist in long-distance air navigation, died recently at the age of 60. He had retired from the R.A.F. in 1950 after being Air Officer in Charge of Administration at Transport Command since 1947.

A.V-M. Mackworth was an instructor in air navigation at Calshot from 1924 to 1925, the following year taking part (as a flight commander) in the U.K. - Cairo - Cape Town and return flight by four Fairey IIIDs under W/C. C. W. H. Pulford. He was in charge of navigational policy at Air Ministry in 1936 and one of his wartime appointments (1944-45) was that of Commandant of the Empire Central Navigation School. He won the D.F.C. in the First World War and was appointed C.B.E. in 1942 and C.B. in 1949.

Lessons of Madrid

THE I.C.A.S. CONFERENCE IN RETROSPECT

IT is now two years since a group representing the aeronautical science institutions of ten countries met at the Hotel Astor in New York to discuss—at a suggestion of Harry F. Guggenheim—the inception of an international organization in the aeronautical sciences. And it is two weeks since the fruit of that 1956 meeting, the first Congress of the International Council of the Aeronautical Sciences, drew to a close in Madrid; time enough to take an overall look at the way in which the aspirations of the diners at the Astor have been fulfilled.

Now whatever the value of an international meeting of scientists and engineers, a Congress comprises a good deal more than just the reading of a number of technical papers. For a period of days researchers and experimenters in various fields are regularly brought together, and the potential scope for an exchange of ideas should provide the greatest possible provocation for further stimulating thought. Thus the lecture sessions, although important, are by no means all of the business of a conference and time off should be a nicely balanced blend of the formal function and private gathering.

Dr. von Kármán, honorary president of the International Council of the Aeronautical Sciences, M. Maurice Roy, chairman of the executive and programme committee, and Col. Antonio Pérez-Marín, chairman of the arrangements committee, undoubtedly understand these tenets very well, for the organization of the Congress was first-class. Madrid in the second week of September could hardly have been bettered as a time and place for such an international meeting. Many transatlantic visitors had attended Farnborough the week before, and the climate of Madrid at this time of the year proved particularly welcoming, being very hot only in the middle of the day when there was a three-hour break in the lecture sessions. Spanish meal times—lunch is taken late and dinner much later than customary by Northern European standards—suited this timetable very well, and an appreciable interval between morning and afternoon sessions did much to alleviate the feeling of mental indigestion that follows, say, some of the Anglo-American conferences. Had both the lecture rooms been air-conditioned, attentiveness might have been better still; the last lecture of the day in the smaller lecture room, the Palacio (particularly when many slides were shown in otherwise total darkness), saw many a struggle between tired eyelids and tired eyes.

The major problem confronting the organizers of such a technical international gathering is clearly the one that began as a punishment for Babel, and it was the multi-linguistic feature of the first I.C.A.S. Congress that first brought home the essential difference between this and an Anglo-American conference. Digressing for a moment, a very pertinent aspect of security is raised in the papers read at such a conference; while each, security-wise, was a model of decorum, a country's *applied* aeronautical effort stems from its progression along the paths of research and is founded upon the ideas and discoveries of its scientists and investigators. Pure research has exclusive application to neither civil nor military fields, but any comparison of ideas will quickly give a clear impression of national progress. And scientists everywhere are loath to be fettered with security when discussing mutual problems with men of their own stature. What is suggested here is not that a security officer from each country should be ready to clap his hand over the microphone, but that a fresh look be taken at information that is classified when it can be simply deduced from published papers.

At Madrid, an attempt was made to resolve the language problem by interpreters who were able to translate the necessarily technical phraseology and by five-language-channel IBM headsets. While this system worked adequately with a lecturer who spoke clearly and slowly, too much was incumbent upon the translator, and at the worst the communication of the ideas which the words were attempting to convey broke down almost completely. Also, amplifying the lecturer's words through loudspeakers on each side of the hall made it harder to concentrate on the translation. A real difficulty is that slides shown on the screen for relatively few seconds cannot adequately be translated if they carry much plain language, and the gist of the illustration is lost. In this context, lecturers should be discouraged from screening very complex slides; there may well be a case for the presentation of more simplified diagrams than appear in the printed paper. An illustration of the effectiveness of this approach was John P. Campbell's review of VTOL and STOL aircraft; he abandoned his printed paper entirely for descriptions relating to a series of short films.

There is considerable significance in this reference to printed papers, because of the 45 lectures presented fewer than 30 were supported with pre-prints, none of which were available before the first day of the congress in Madrid and only one of which—Dr. von Kármán's Guggenheim memorial lecture—was even eventually available in other than the language in which it was given. And although good impromptu questions can be (and were) asked, there is no substitute for a careful point-by-point study of what is going to be said. Discussion of most papers was sharply attenuated in consequence. In other circumstances it might have been the rather brief periods left for questioning that were the subject of criticism; but, in the event, and particularly towards the beginning of the week when it was physically impossible for many of the papers that were available to have been digested, discussion was generally dull; there was little of the cut-and-thrust and probing that a penetrating question can bring. Where so much money, and the time of 500 delegates, all of some importance, is involved, it is surely not too much to ask that papers are submitted and printed in good time?

In spite of this defect, the congress fulfilled its purpose admirably. The papers were generally of a high standard (although the review pure and simple may be out of place) and there were senior technical men from every country represented. There was some unevenness in the representation, some aeronautical concerns sending several of their senior research and design staff while others sent none; but it was good to see a number of young engineers and researchers present. Britain was quite well represented both with delegates and authors, and the Greatrex paper on noise, Keith-Lucas's lecture on VTOL and Lighthill's on *Dynamics of a Dissociating Gas* were well received. Frequent references to Professor Lighthill's work in the fields of noise and aerodynamics showed him to be one of the lions of the conference. Later it was announced that the leader of the British delegation, Sir Arnold Hall, had been elected a member of the Council of the Congress. The Council intends to hold a similar international Congress every two years. A last-minute attendance at Madrid was made by a Soviet delegation, the leader of which, Anatole Dorodnitsyne, read a paper on transonic flow; in 1960 the Russians may be expected to appear in force. A. T. P.

Below is continued last week's summary of the lectures.

VTOL AND STOL

One complete morning during the Congress was devoted to a special session on short and vertical take off and landing. Contributions were forthcoming from the U.K., the U.S.A., and from France. First paper in the series was **John P. Campbell's** *Research on VTOL and STOL Aircraft in the United States*, a summary of recent widespread work in this field. Of the breakdown of 24 types (see the table, p. 518), said Mr. Campbell, 18 have been the subject of research by industry, the armed services, or the N.A.C.A. A significant feature of the work has been the use of flying test-beds as simple and relatively inexpensive research machines. In classifying types on a propulsive basis, rotor configurations have been distinguished from propeller configurations by the use of helicopter type disc loadings and/or the use of cyclic pitch control in hovering. As the title implies, the entire paper was devoted to a review and description of the various machines which have been involved. Summarized here are the author's comments on the various configurations. A point well

The sketch above, showing the traditional figure of Don Quixote on his wooden horse Clavileño flying over the Spanish castle Peñafiel, was designed especially for the occasion. The heading picture was taken during one of the sessions in the Instituto Nacional de Previsión.

	ROTOR	PROPELLER	DUCTED FAN	TURBOJET
Dual Propulsion	McDonnell XV-1 (AF-A) [Sikorsky] (AF-A) NACA		[Vertol Vertodyne] (N-A) [Ryan Vertifan] (U) NACA	NACA
Thrust Redirection 1. Thrust tilting	Bell XV-3 (AF-A) Transcendental (AF-A) [Kellett K-25] (A) NACA	Vertol 76 (N-A) Hiller X-18 (AF) NACA	Doak 16 (A) [Bell transport] (U) [Hiller transport] (N) NACA	Bell air test vehicle (U) Bell Fighter (N, AF) [Bell transports] (U) NACA
2. Thrust deflection	[Kaman K-16] (N)	Ryan 92 (N-A) Fairchild M-2241 (A) Robertson (U) NACA	[Piasecki Ring Wing] (N) [Collins Aerodyne] (N-A) [Goodyear Convoplane] (A)	VTOL: Bell X-14 (AF) [Collins Aerodyne] (U) NACA STOL (Jet flap): [Martin, Fairchild] (N-A) NACA
Aircraft Tilting 1. Tail-sitter airplane		Convair XFY-1 (N) Lockheed XFV-1 (N) NACA	[Hiller Coleopter] (U) [Fletcheire Coleopter] (U) NACA	Ryan X-13 (AF) NACA
2. Flying platform	Delackner Aerocycle (A) NACA		Hiller flying platform (N-A) NACA	
3. Aerial jeep		Aerophysics jeep (A) NACA	Piasecki jeep (A) Chrysler jeep (A) Aerophysics jeep (A) NACA	

Table indicating VTOL/STOL types under study in the U.S.: A = ARMY (Transportation Research and Engineering Command—TRECOM); AF = AIR FORCE; N = NAVY (Office of Naval Research (ONR) or Bureau of Aeronautics); AF-A = AIR FORCE for ARMY; N-A = NAVY (ONR) for ARMY; U = UNSPONSORED; letters NACA indicate National Advisory Committee for Aeronautics research on this type. Construction of flight test vehicles for those projects shown in brackets has not been undertaken.

worth noting is that a number of experimental machines, having served their purpose, have been retired to the Smithsonian museum.

Rotor Configurations: An unloaded-rotor type convertiplane of multi-propeller tractor configuration, powered by gas turbine engines, would be an excellent VTOL aircraft for certain operations. Although no work is being done on this type in the U.S. at present, the success to date of the Fairey Rotodyne does seem to indicate promise for such an aircraft.

Propeller Configuration: The tilting-wing-and-propeller VTOL-STOL aircraft, designed on the basis of previous N.A.C.A. studies, represents a promising type.

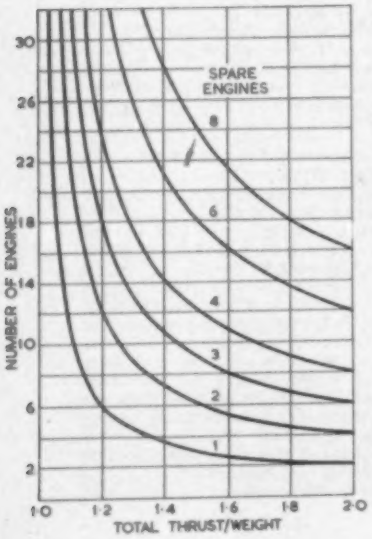
N.A.C.A. research on the two basic VTOL propeller types that make use of the thrust re-direction principle has indicated that the deflected slipstream machine is superior for STOL operations while the tiltwing is superior for VTOL. The deflected slipstream type has a lower power requirement for low speed flight but suffers a substantial thrust loss while hovering, and has a generally more severe longitudinal trim problem and more detrimental ground effect than the tilt-wing. Perhaps some combination of the deflected slipstream and tilt-wing principles will prove the best propeller driven type for overall VTOL-STOL operation.

Tail Sitters: During the last few years no research work at all has been done by N.A.C.A. on this VTOL type because there appears to be little interest in such configurations.

Ducted Fans: Considerable interest is being shown although no dual-propulsion VTOL aircraft which use ducted fans for hovering and turbojets for forward flight are being built at the moment.

A basic problem of the ducted fan submerged in a wing appears to be the difficulty of integrating a fan of the size required without compromising performance in forward flight. Several research studies are being done into ducted fan VTOL aircraft which make use of the thrust redirection principle. Work is being done on both the thrust tilting and thrust deflection types. Research is being done on all three ducted fan VTOL types that involve tilting of the entire aircraft for forward flight.

Flying Platforms: Hiller's work indicated the feasibility of kinesthetic (natural balance) control but also revealed the basic problems involved, such as the difficulty of obtaining adequate longitudinal trim for moderate forward speeds by only a shift of the pilot's centre of gravity.



Curve from Mr. Keith-Lucas' lecture showing the way in which thrust/weight ratio is dependent upon the number of installed engines and the number that can be considered as spare.

Aerial Jeeps (aircraft-tilting VTOL): Investigation indicates the feasibility of the type, but also problems of stability and control.

Turbojet Configurations: The lifting engine machine has received less attention in the U.S. than in England, but interest is increasing. An N.A.C.A. study of a jet transport with tilting engines at the side of the fuselage indicates promise for short-range missions that involve low altitudes and high subsonic speeds.

Jet Flap: A canard configuration is promising from the standpoint of longitudinal stability and trim. Flattened nacelles over the wing appear to afford desirable noise-reduction.

The British contribution to the subject was a paper by **Mr. D. Keith-Lucas** of Short Bros. and Harland on *Safety and Reliability Aspects of VTOL*. Mr. Keith-Lucas was one of the few lecturers who had troubled to memorize his paper so that he could deliver it without any reference to notes at all. He first outlined the likely operational procedures and problems of the SC.1 type vertical take-off aircraft, emphasizing that blind landing techniques—with altitude held constant by autostabilizer, deceleration fixed by engine tilt angle and by constant attitude, and flight path controlled by lift engine throttles operated by an I.L.S. coupler—would have to be used. Next, Mr. Keith-Lucas discussed the thrust/weight ratio requirements for adequate vertical response. We must, he said, strike a balance between the penalties of restricting the rate of descent and providing additional thrust so as to allow higher rates of descent; in general it appears that a margin of about 10 per cent of thrust over weight is needed, although (due to response lag) 15-20 per cent seems desirable.

Landing allowances must be carefully considered because of high consumption in hovering flight. VTOL aircraft must be designed so that they do not need runways for landing in the event of a mechanical failure, or failure of the lifting engines to start after protracted exposure at altitude. VTOL stand-off allowances, it was suggested, should be half those of conventional aircraft.

The number of engines and the thrust required raises a number of questions. The probability of take-off engine failure in conventional aircraft is 1 in 10^5 and, by probability, the failure rate of one engine in four is equivalent to two failures in about 900. If the VTOL aircraft has four engines, thrust-weight ratio must be 1.33 to give the same reliability as a conventional four-engined aircraft. For practical numbers of engines the probability of two failures in any one take-off is always less than one failure on a four-engined aircraft. In VTOL designs, however, it may be necessary to close down an opposite engine in order to maintain the trim, and common failure must be eliminated.

From the safety point of view, the VTOL aircraft autostabilizer requires special consideration. It must never be allowed to fail, we must make it as reliable as we know how and then duplicate or triplicate or even quadruplicate as necessary. The real problem is whether triplication—or, as Mr. Majendie calls it, a triplex system—is enough; it only provides for one failure in three channels whereas a quadruplex system provides for two failures in four channels. Reliability is not going to be obtained by the use of components that are 100 per cent reliable, but rather by components that are not completely reliable in a system which is so designed that the malfunctioning of the component has an insignificant effect. We must face up (the author concluded) to the full implications of flying an aircraft on which for part of every flight the lift is wholly dependent upon engines and the control wholly dependent upon automatic equipment. Without all this we may find that we have the aircraft but not the means of using it.

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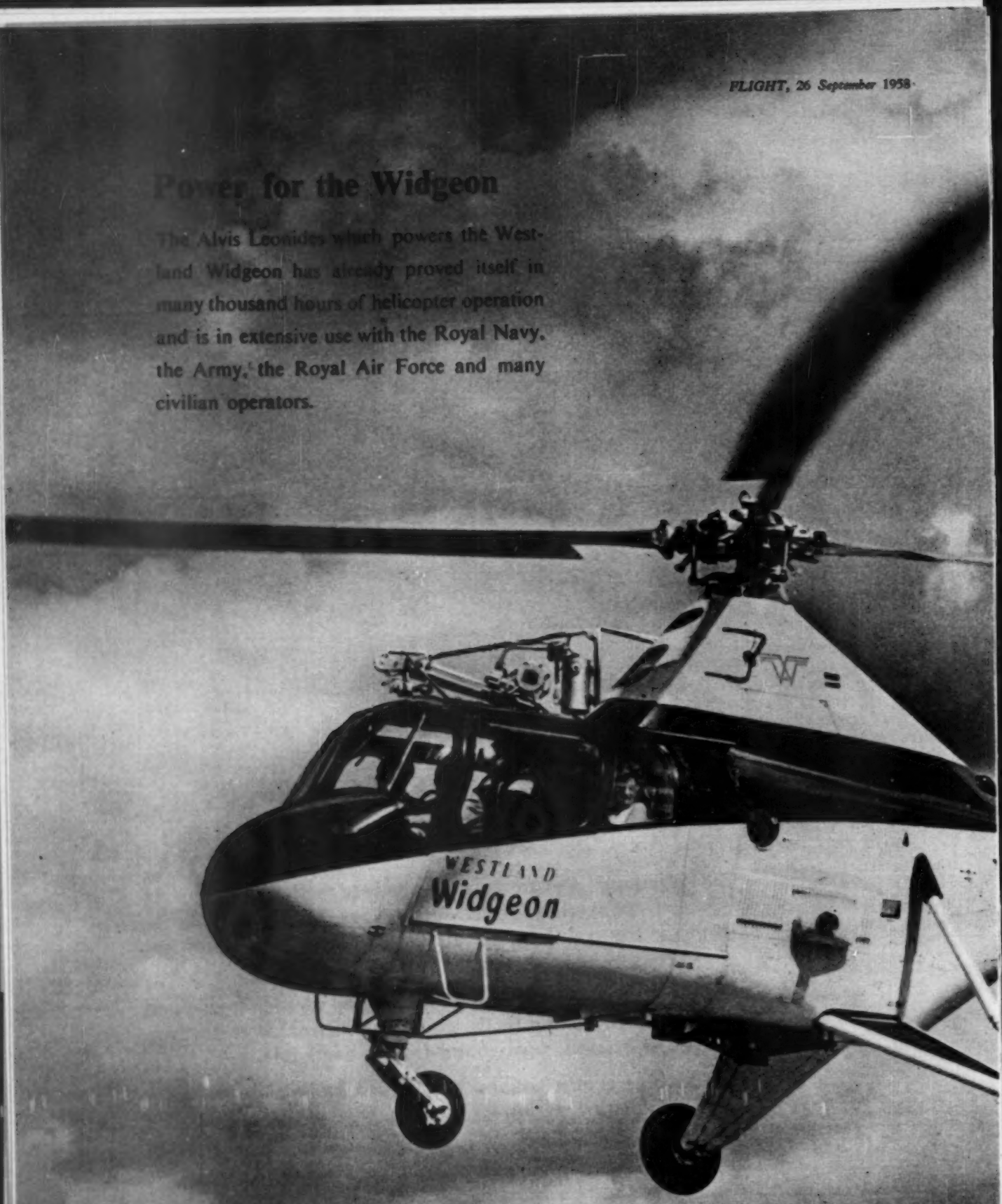


ALVIS LEONIDES AERO ENGINES

ALVIS LIMITED COVENTRY ENGLAND

Greatest Load-carrier in the Western World

C-133 CARGOMASTER

CREDIT for evolving the optimum form of heavy military freighter rightly belongs to the Germans, whose Me 323, Ar 232 and Bv 144 were the first to combine a high wing, a cavernous and unrestricted hold, rear full-section doors for rapid loading and heavy dropping and a multi-wheel landing gear faired directly into the fuselage. With the U.S.A.F.'s Lockheed C-130 and Douglas C-133 this configuration has been brought up to date and combined with pressurization and turbine propulsion. The Lockheed is now well known, but little has been written about the C-133, notwithstanding the fact that its payload/range performance surpasses that of any other known machine in its class. It is particularly appropriate to examine this very capable vehicle at a time when somewhat similar aircraft are belatedly being considered by R.A.F. Transport Command.

At their Long Beach, California, division, Douglas Aircraft built 446 C-124 Globemasters between 1951 and 1956. Soon after the C-124 entered service, the U.S.A.F. and Douglas began to study projected designs with greater payload, range and performance. First of these to be built was the YC-124B, in which a pressurized flight deck allowed the greatly increased power of four Pratt and Whitney T34 turboprops to be utilized. This machine was flown from early 1954 to early 1956. Meanwhile, extensive research had indicated that pressurization of the whole C-124 fuselage would impose unacceptable weight penalties, and there was therefore no alternative but to prepare a completely new design.

By October 1952 the Douglas 1324 was proposed to, and accepted by, the Air Force, and Douglas began detail design of this C-124 derivative with a pressurized, circular-section fuselage. Soon, however, the customer requested ability to load from truck-bed height, and accordingly the high-wing Model 1333 was evolved in February 1953. The official specification was submitted in June 1953, and by August the project had become the U.S.A.F. C-133A (named Cargomaster earlier this year). Basic criteria included: a design range mission of 3,500 nautical miles with 50,000 lb cargo; a design radius mission of 1,500 n.m. with the same load; take-off to 50ft at maximum weight in 5,000ft; and truck-bed loading.

Throughout the design exceptional emphasis was placed on such operational aspects as good handling, compatibility with existing support equipment, easy maintenance and, in general, ensuring that the 133's development and shakedown period would not be protracted. The Long Beach engineers succeeded handsomely. The first off the line—there was no prototype—flew on April 23, 1956, on a 1 hr 40 min trip, landing at Edwards A.F.B.; in the following 30 days it logged 33 hours in the air, a Douglas all-time record which was not even beaten by the DC-8. Vice-president and general manager at Long Beach is Mr. Kenneth G. Farrar; chief engineer was John C. Buckwalter when the programme began, but since 1955 this post has been filled by Carlos C. Wood.

Structurally the 133 is conventional, and little need be added to the information obtainable from the cut-away drawing. Standard aluminium-alloy sheet and sections are used, with flush riveting and bonding; steel and magnesium alloys are used in certain areas, and the many doors and fairings are stabilized by glass-fibre and honeycomb. The main floor consists of longitudinal beams, transverse bulkheads, an aluminium-alloy diaphragm and removable plywood top panels. The wings have two spars, plate ribs, spanwise stiffeners and thick inter-spar skins 58ft 6in long (so long that their cross-country transport from the machining plant originally posed great problems, and heat-treatment has to be carried out with the skins coiled).

The double-slotted flaps are actuated hydraulically (electric emergency) by ball-bearing screw-jacks; settings are 0, 15, 25, 35 and 45 deg. All flying controls are manually operated by two-way cable systems. The pilot's effort is divided between the main surfaces and control tabs, the latter providing aerodynamic boost. Vortex generators are provided above and below the wing to increase aileron effectiveness, replacing the hydraulic boosters which were originally fitted to improve the rate of roll. Static and dynamic stability are positive about all axes; nose- and tail-wagging during rapid rolling manœuvres is unavoidable in a long-bodied aeroplane, and is almost the only unpleasant characteristic of the big Douglas.

Undercarriage geometry is depicted in a sketch on p. 522. Forged brackets at each of two stations in the fuselage centre section carry almost vertical legs of hollow rectangular section. From these a levered-suspension linkage extends to the rear, the horizontal axle on each linkage carrying two wheels (a total of eight). Retraction and extension of the forward or rear sets of wheels can be individually controlled for changing tyres, although normally all four main legs operate together. The steerable nose unit has twin wheels and carries forward-facing lamps and a loudspeaker. Twin wheels, with solid rubber tyres, are provided beneath the rear fuselage for use during nose-high landings.

Power for the C-133 is provided by four Pratt and Whitney T34 turboprops. These single-shaft engines have a long history, which in its early years was somewhat clouded; but today they can be regarded as very well developed and they are well-liked by the M.A.T.S. air and ground crews. All marks of C-133 have Curtiss Turbolectric propellers, each having three extruded hollow-steel blades with a diameter of 18ft (largest propellers in the Western world). Most current C-133As have the T34-P-7W engine, with ratings as listed in the data table. From the 35th machine a more

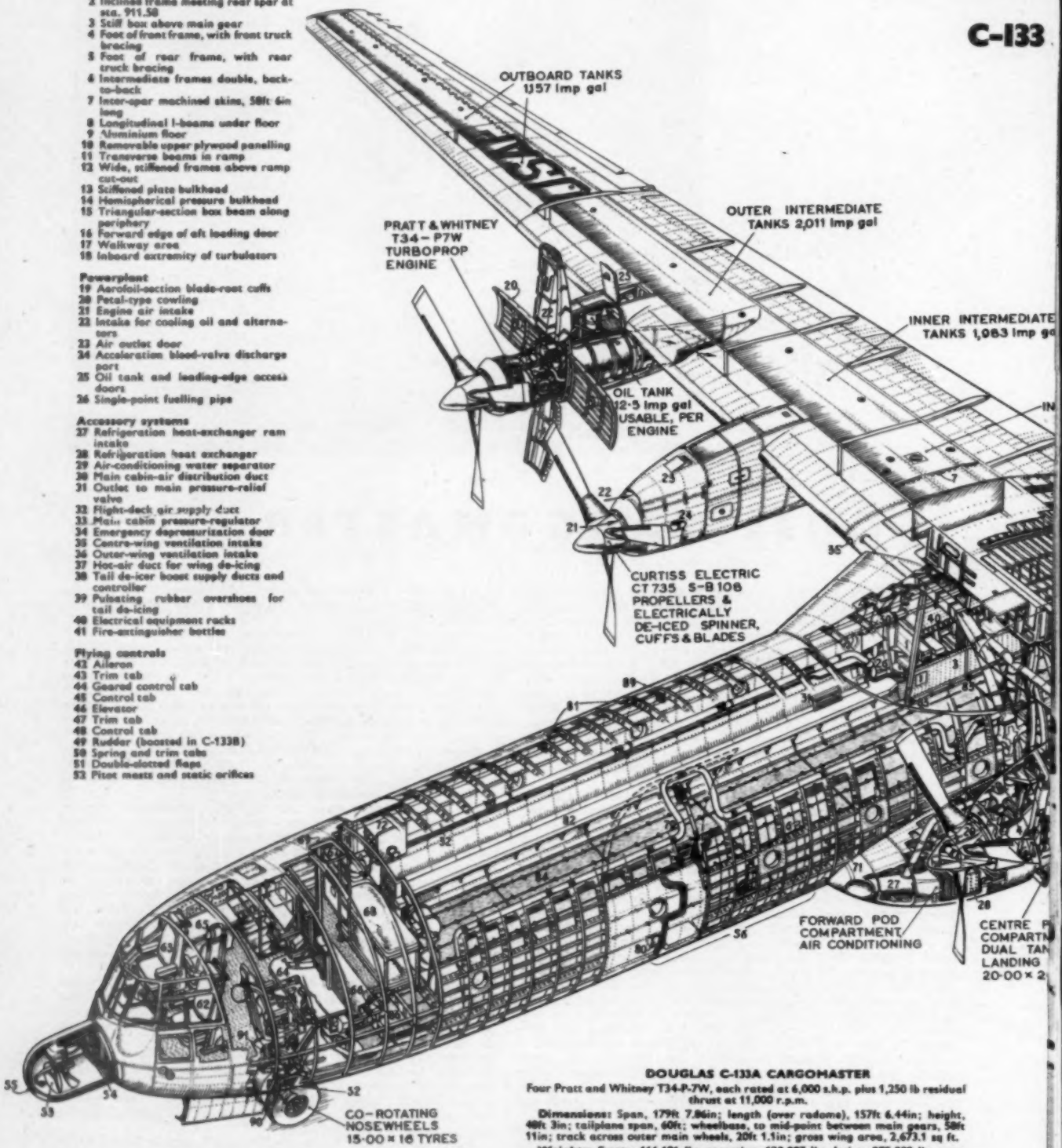
C-133

Structure
1 Inclined frame meeting front spar at sta. 782.715
2 Inclined frame meeting rear spar at sta. 911.58
3 Stiff box above main gear
4 Foot of front frame, with front truck bracing
5 Foot of rear frame, with rear truck bracing
6 Intermediate frames double, back-to-back
7 Inter-spar machined skins, 58ft 6in long
8 Longitudinal I-beams under floor
9 Aluminium floor
10 Removable upper plywood panelling
11 Transverse beams in ramp
12 Wide, stiffened frames above ramp cut-out
13 Stiffened plate bulkhead
14 Hemispherical pressure bulkhead
15 Triangular-section box beam along periphery
16 Forward edge of aft loading door
17 Walkway area
18 Inboard extremity of turbulators

Powerplant
19 Aerofoil-section blade-root cuffs
20 Petal-type cowling
21 Engine air intake
22 Intake for cooling oil and alternators
23 Air outlet door
24 Accelaration bleed-valve discharge port
25 Oil tank and leading-edge access doors
26 Single-point fuelling pipe

Accessory systems
27 Refrigeration heat-exchanger ram intake
28 Refrigeration heat exchanger
29 Air-conditioning water separator
30 Main cabin-air distribution duct
31 Outlet to main pressure-relief valve
32 Flight-deck air supply duct
33 Main cabin pressure-regulator
34 Emergency depressurization door
35 Centre-wing ventilation intake
36 Outer-wing ventilation intake
37 Hot-air duct for wing de-icing
38 Tail de-icer boost supply ducts and controller
39 Pulsating rubber overshoes for tail de-icing
40 Electrical equipment racks
41 Fire-extinguisher bottles

Flying controls
42 Aileron
43 Trim tab
44 Geared control tab
45 Control tab
46 Elevator
47 Trim tab
48 Control tab
49 Rudder (boosted in C-133B)
50 Spring and trim tabs
51 Double-slotted flaps
52 Pitot masts and static orifices



DOUGLAS C-133A CARGOMASTER

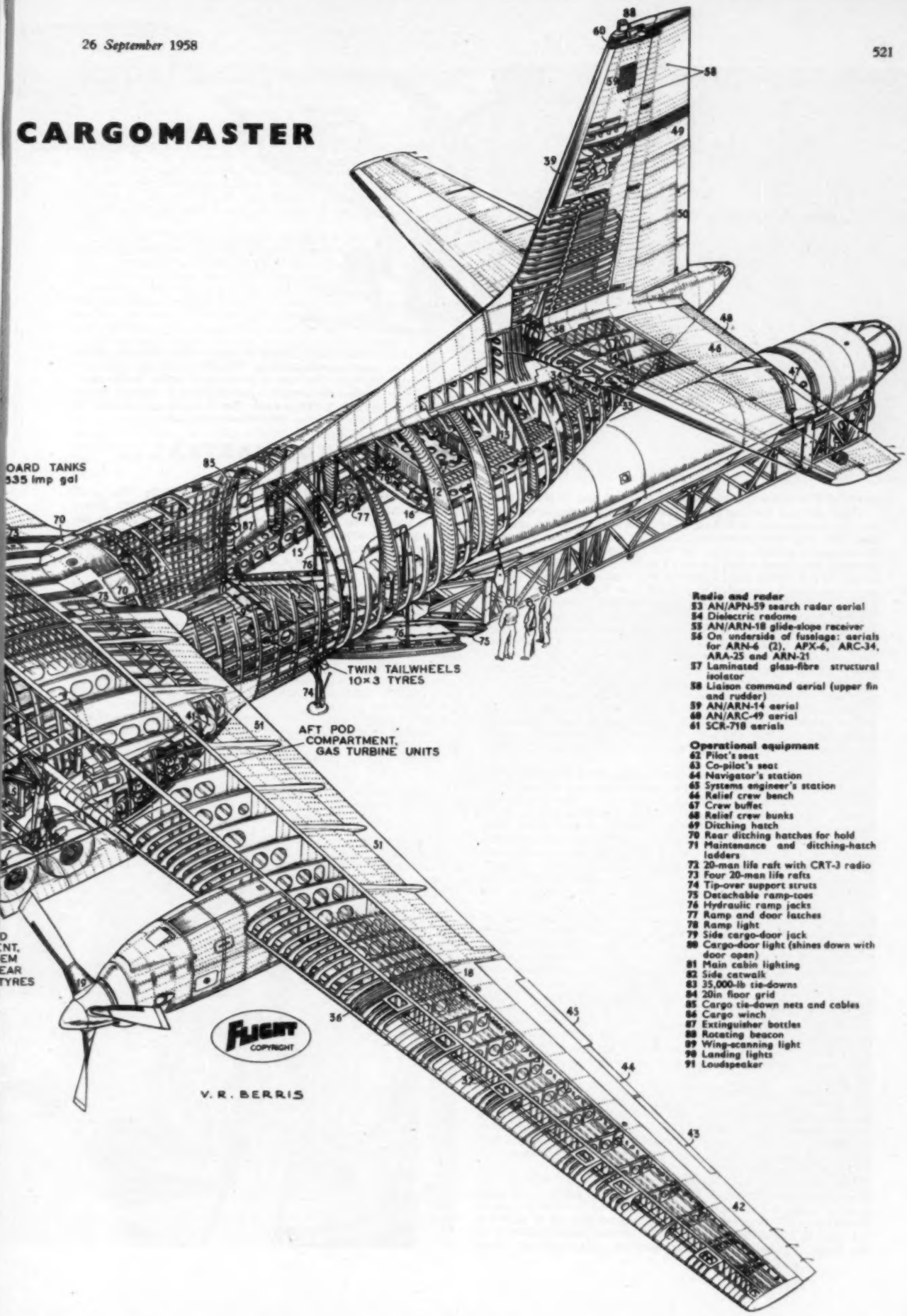
Four Pratt and Whitney T34-P-7W, each rated at 6,000 s.h.p. plus 1,250 lb residual thrust at 11,000 r.p.m.

Dimensions: Span, 179ft 7.86in; length (over radome), 157ft 6.44in; height, 48ft 3in; tailplane span, 60ft; wheelbase, to mid-point between main gears, 58ft 11in; track across outer main wheels, 20ft 1.1in; gross wing area, 2,673.1 sq ft.

Weights: Empty, 116,191 lb; operating, 120,007 lb; design, 275,000 lb; max. take-off, 275,000 or 282,000 lb; max. landing, normal 245,000 lb, limit 282,000 lb (limited by 5ft/sec, 1-g wing lift); max. cargo capacity (limited by zero-fuel weight, 2.18 load factor), 114,993 lb.

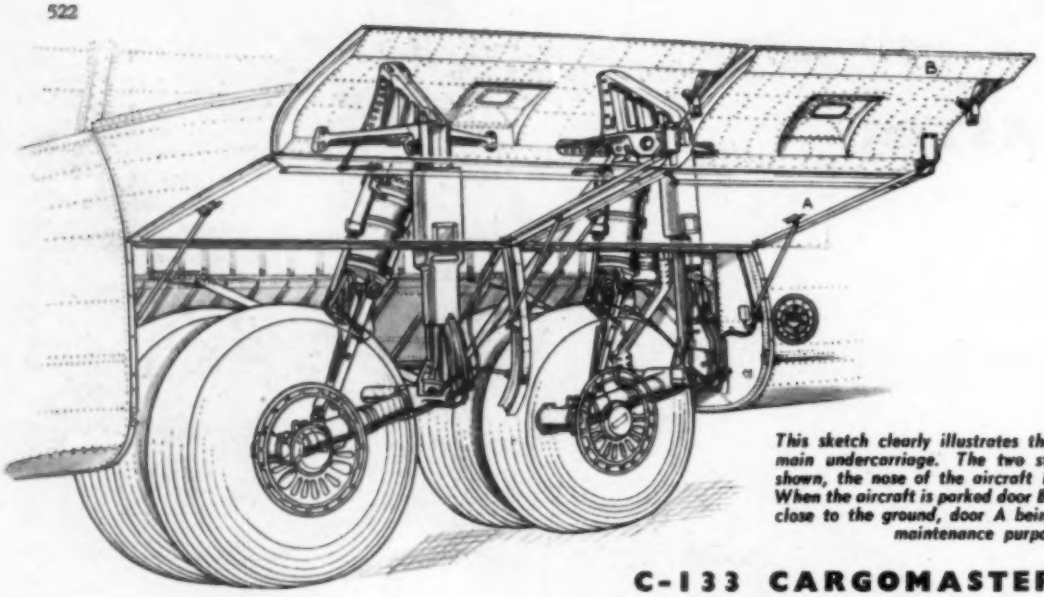
Performance: Ground run at full load (standard day, s.l.), about 5,000ft; initial climb, about 1,000ft/min; normal cruising speed at 80 per cent power at 20,000ft, 310 m.p.h.; max. speed, 355 m.p.h.; typical payload/range figures, 41,700 lb for 4,030 statute miles o. 100,000 lb for 1,300 st.m. (C-133B, 53,000 lb for 4,000 st.m. or 91,000 lb for 2,300 st.m.); stalling speed at 245,000 lb, about 105 m.p.h.

CARGOMASTER



Radio and radar
53 AN/APN-59 search radar aerial
54 Dielectric radome
55 AN/ARN-18 glide-slope receiver
56 On undersids of fuselage: aerials for ARN-6 (2), APX-6, ARC-34, ARA-25 and ARN-21
57 Laminated glass-fibre structural isolator
58 Liaison command aerial (upper fin and rudder)
59 AN/ARN-14 aerial
60 AN/ARC-49 aerial
61 SCR-718 aerials

Operational equipment
62 Pilot's seat
63 Co-pilot's seat
64 Navigator's station
65 Systems engineer's station
66 Relief crew bench
67 Crew buffet
68 Relief crew bunks
69 Ditching hatch
70 Rear ditching hatches for hold
71 Maintenance and ditching-hatch ladders
72 20-man life raft with CRT-3 radio
73 Four 20-man life rafts
74 Tip-over support struts
75 Detachable ramp-toes
76 Hydraulic ramp jacks
77 Ramp and door latches
78 Ramp light
79 Side cargo-door jack
80 Cargo-door light (shines down with door open)
81 Main cabin lighting
82 Side catwalk
83 35,000-lb tie-downs
84 20in floor grid
85 Cargo tie-down nets and cables
86 Cargo winch
87 Extinguisher bottles
88 Rotating beacon
89 Wing-scanning light
90 Landing lights
91 Loudspeaker



This sketch clearly illustrates the geometry of the main undercarriage. The two starboard units are shown, the nose of the aircraft being to the right. When the aircraft is parked door B is normally hinged close to the ground, door A being opened only for maintenance purposes.

C-133 CARGOMASTER . . .

powerful T34 is being introduced, as outlined later in this article.

There are four cowling petals, the uppermost containing an air duct for the oil cooler with a separate bleed for cooling the alternators. For cold-weather starting, warm air can be discharged over the accessory section to heat the fuel control and provide hand-warming for maintenance crews. The fire-suppression system is served by two Freon 12B2 bottles in No. 2 nacelle. Thrust, power and r.p.m. are all controlled by a single lever for each powerplant; the propellers have cockpit "condition levers," which can select "feather," "fuel OFF," "fuel ON," "run" and "air start."

Total fuel capacity is 15,081 Imp. gal. Four bladder-type cells are housed in the constant-section box which joins the port and starboard centre wings. The latter, which extend out to station 646 (aileron inboard end) contain three integral tanks on each side, and the outer panels form integral tanks from root to tip, the capacity of each outer wing being 3,169 Imp. gal. The entire system is pressure-fuelled at up to 1,000 Imp. gal/min from a single socket immediately ahead of the port fuselage "pod" (see next paragraph), and from the 13th aircraft onward provision is made for jettisoning from a trailing-edge outlet at the outboard end of each centre wing.

The large fairings, or pods, into which the main gear units retract provide much valuable space which has been utilized to the full, particularly in the case of the port pod. The forward section contains all the major units of the air-conditioning system, while the aft end houses two gas-turbine auxiliary power units. Both are AiResearch GTU-85-2 units (it may be remembered that Armstrong Siddeley Motors hold a licence for such equipment), each of which can supply shaft power on the ground or in flight, as well as air for engine starting, cabin pressurization and ground ventilation. Shaft drives are provided for the hydraulic and emergency electric services. At maximum power the GTUs make an exhaust which, at a distance of 20ft from the outlets, is moving at 175 kt and is as hot as 325 deg F. The mass flow, however, is small, and the effect soon subsides as distance is increased.

Normal operating crew comprises pilot, co-pilot, systems engineer and navigator, with sleeping accommodation for a relief crew of three. The flight deck, illustrated in a photograph, is spacious and beautifully laid out; American aircraft are usually particularly good in this respect. Circuit switches, starter controls and similar units occupy the roof panel, the main console carries powerplant and fuel levers and a lower, rear console is provided for grouped electronics controls; the GTUs and all accessories, fuel management and de-icing are handled by the systems engineer.

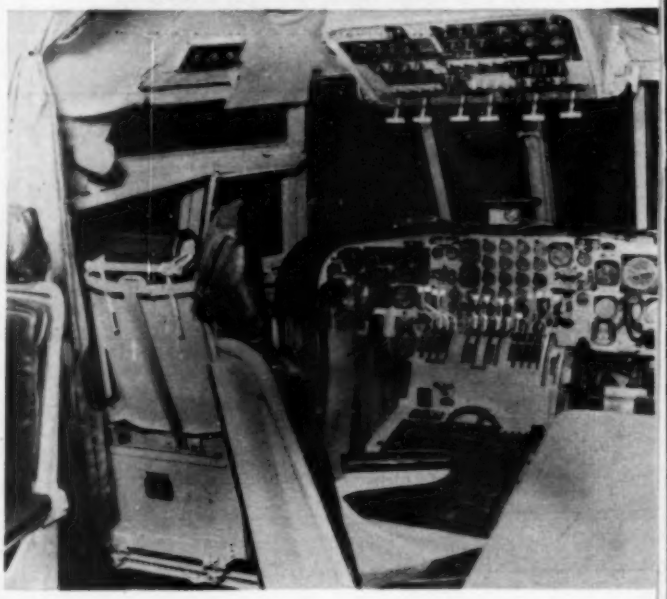
Gross usable volume of the cargo hold is 13,000 cu ft; and an indication of what this means may be provided by stating that the corresponding volume of the AW.650 Argosy is 3,680 cu ft. The entire volume is pressurized to an interior altitude of 8,000ft at 30,000ft, or to 10,000ft at 35,000ft. Access is gained via the full-section rear ramp or by a forward door on the port side measuring 100in high by 106in wide.

Diameter of the basic cylinder is 16ft and the flat floor, 50in from the ground, measures 982in by 142. Total area is 1,141 sq ft, and the ruling design loading case is 300 lb/sq ft; loading capacity varies up to 375 lb per running inch, and vehicles up to 20,000 lb per axle, or 76,000 lb tracked, may be accommodated directly on the floor. The whole area is covered by a 20in grid on which are located tie-downs rated at from 5,000 to 35,000 lb. The maximum comfortable number of seats is certainly well over 250. Heavy cargo is winched in across a roller system (also used during air-dropping) in a conveyor system arranged to accommodate 10ft by 8ft panels of cargo or 40in by 48in pellets. Douglas holds a contract for the development of a scheme for loading any 100,000-lb cargo within the turn-round time of the aircraft.

The first C-133A bears the U.S.A.F. serial number 54-135, and it flew on April 23, 1956. The first aircraft delivered to the Air Force was the ninth off the line (54-143) and it flew to Dover A.F.B. on August 27 last year. There it joined the 1607th Air Transport Wing (Heavy) of the Military Air Transport Service. Until recently production was running at the artificially low rate of one C-133A per month. Nearly all the first batches, totalling 36 aircraft, have now been completed. America's urgent need for really capable, "global" logistics aircraft—a category in which the 133 is supreme, so far as presently available machines are concerned—is certain to lead to substantially increased production.

From the 35th machine onward the configuration is changed to the C-133B. This model, although superficially identical, has the T34-P-9W engine, providing 12 per cent more power and 5.4

The flight deck is roomy and seats an operating crew of four. The large wheel mounted centrally above the fascia is rudder trim; nosewheel steering has a wheel on the port side.



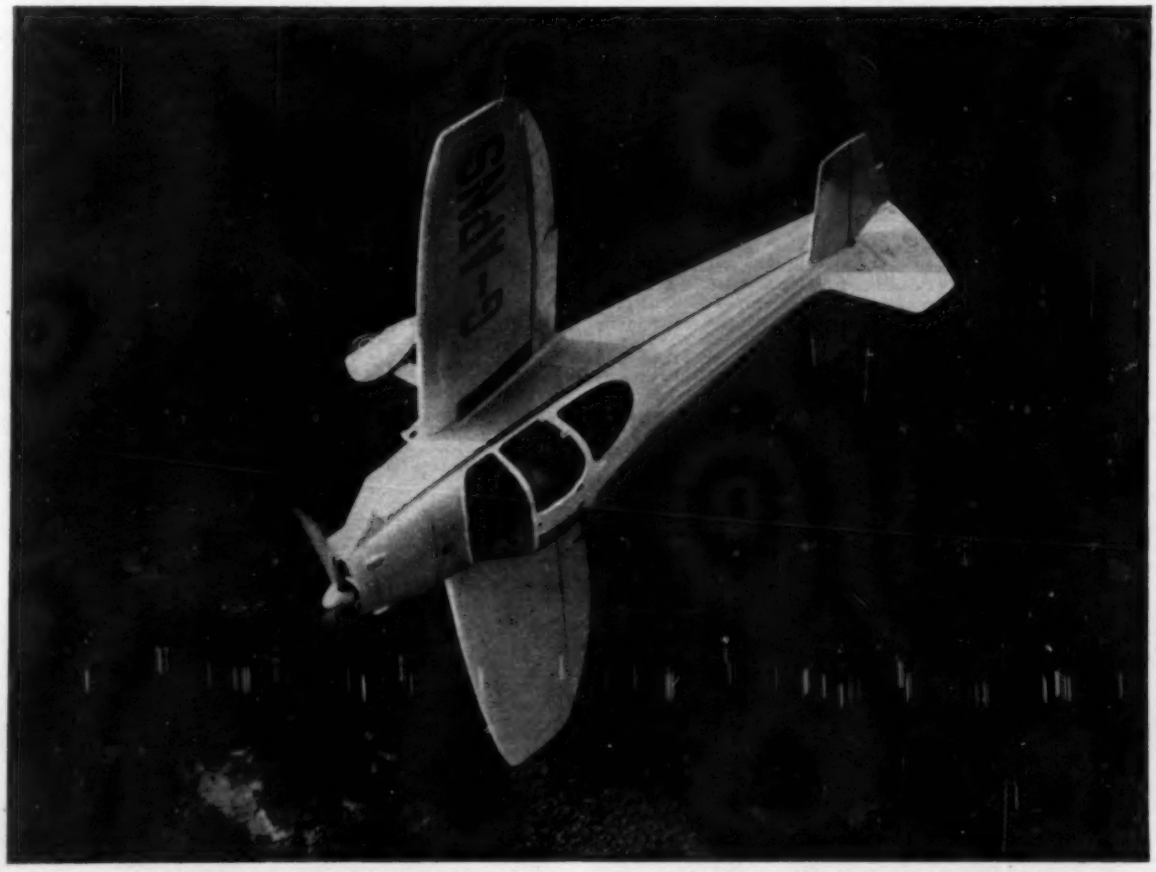
A view of the 13,028 cu ft interior, looking forwards. The largest vehicles can be accommodated, as well as such voluminous missiles as Snark and Atlas.

per cent lower specific consumption. At the same time, structural changes have been made to clear the B model for operation at 286,000 lb, and hydraulic boost has been added to the rudder. Localized changes have also been made to the peripheral shape of the rear ramp/door, to facilitate the loading of the largest missiles. Fifteen of the new model have been ordered, and supplemental budgets, or the next fiscal year, should see the number climb rapidly.

At present the 133 is the only machine in the West which can carry all the West's missile systems (vehicles, launchers, support equipment and the missiles themselves, which in the case of Atlas and Titan are from 79 to 90ft long, and 10ft in diameter). Air transport of such systems is absolutely essential, even during their pre-operational period, and it is also much cheaper than any surface transport. Cost per 2,000-lb nautical mile for the C-133B is expected to be not greater than five cents in most types of operation, and this may be low enough to make so large a machine attractive to one or two of the largest commercial operators.

Be that as it may, the 133 is the best vehicle in the world for an operator who wishes to take the most cargo the farthest distance, and its direct costs are extremely competitive. Our aim in presenting this appraisal has, in part, been to publicize a little-known workhorse which will take some beating. As the even larger C-132 was cancelled a year ago there is no aeroplane in prospect which can match the load-carrying ability of the 133, and it may still be trickling off the Long Beach line ten years hence.

The Hand that Reined the Hunter Pets the Linnet



This picture of the Garland-Bianchi Linnet, by "Flight" photographer L. W. McLaren, has a particular dainty charm—especially after the sound and fury of Farnborough; and it brings again to our pages the zestful flying of Neville Duke. (See also overleaf.)

"Flight" photographs

At the aerobatic contest at Dunstable: left, the Olympia 415 flown by the winner, David Ince; right, the judges in action.

CLUB AND GLIDING NEWS

FOR the second year running, an aerobatic contest for sailplanes was held at the Dunstable Downs site of the London Gliding Club on Sunday, September 21. Dignified by the title National Glider Aerobatic Contest and by official sponsorship by the British Gliding Association, this year's competition was won by David Ince flying the Elliott-entered Olympia 415. Second was F/L. J. R. Ayers, Army Gliding Club (Slingsby Skylark 2) and third was Dan Smith in the new 13-metre Slingsby Swallow.

At the 9.30 a.m. briefing it was decided to lower the specified release height from 2,500ft to 2,000ft while retaining the 500ft minimum height, and to reduce the compulsory manœuvres to one loop and one chandelle. Judging, by the Lockheed International Aerobatic Trophy panel, would be on the basis of scope, accuracy, artistry and positioning, and originality, with spot-landing accuracy as a deciding factor if necessary.

First away at 11.35 behind one of the London club Tigers was John Messervy in the Skylark 2 from Lasham. Particularly notable among the eleven morning competitors was the crisp spinning of the Kite 2 flown by Arthur Doughty, and the inverted flying of Sharman and Gough in the R.A.F.'s Olympia 419, Ince in the 415 and Smith in the Swallow. Six further pilots flew after lunch.

In the judges' report the performance of Frank Foster in his Skylark 2 was commended, but his disregard of the minimum-height limitation was said to have resulted in a heavy deduction of marks. The Jack Hanks Trophy for the winner and the other prizes were presented by Sir Frederick Handley Page.

PLANS for a major reorganization of the flying operations at Lasham Gliding Centre are now being made, following a special meeting of member-clubs and private owners on Saturday, September 13. A new committee has been formed to draft proposals for a central organization which might act as a glider training school and which would operate separately from the several Lasham-based clubs. The overall objective is to make Lasham a gliding centre rather than simply a club and private-owner site. This is a new development in British gliding and one that could lead to important changes in the instructional gliding sequence and in advanced training. Recently appointed general manager of Lasham Gliding Centre, a newly created position, is Lt-Cdr. John Phillips.

VARIETY both in weather and in aircraft types was a feature of Denham Flying Club's garden party on Sunday last, September 21. The smallest machine there, the Rollason Turbulent displayed by Norman Jones, was watched in bright sunshine, while the largest and heaviest item on the programme, a fly-past by ten R.A.F. Javelins, brought spectators out from the shelter of the marquee into a steady downpour. Among the other aircraft displayed were Hawker Tomtit G-AFTA (David Lockspeiser), Supermarine Spitfire (Jeffrey Quill), Rollasons "Bishop" Tiger Moth (C. Nepean Bishop), a U.S.-registered Aeronca Champion of South Ruislip Aero Club (V. Koteek) and the attractive Coopavia Emeraude (Francis Couesnon). Beverley Snook delivered an elegantly casual commentary, and the prizewinners were William Everley, Auster J.1N (spot-landing and flour-bombing contests); Hector Laing, Messenger (smartest Denham-based aircraft); and Francis Couesnon, Emeraude (smartest visiting aircraft).

ROLLASON Aircraft and Engines, Ltd., of Croydon Airport have been appointed sole U.K. and Commonwealth agents for the French company Société Aéronautique Normande, manufacturers of the Jodel D.117 and the D.140 Musketeer. The Rollason company will be collecting a D.117 demonstrator in the near future, which will be registered G-APOZ and is to be submitted to the A.R.B. for validation of its French certificate of airworthiness.

A new project of Société Aéronautique Normande, in association with le Centre Est Aéronautique at Dijon, is the three-seater Jodel DR.100 Ambassador which is to be produced in quantity. Carrying three persons, 44 lb of baggage and 25 Imp. gal of fuel, the DR.100 should cruise at about 125 m.p.h. and have a landing speed of 31 m.p.h. Fitted with airbrakes, the standard version of the type will sell at 2,850,000 francs (£2,425) excluding export taxes. Delivery should begin January and production should continue at a rate of 10 to 15 machines per month.

FORTHCOMING events organized by the Kronfeld Club include the annual general meeting on Wednesday, October 22, an exhibition of paintings of sailplanes and light aeroplanes during November 3-7 (both events at the club premises, 74 Eccleston Square, London, S.W.1) and a dinner-dance at the Eccleston Hotel on Friday, November 7.

Two further views of the Garland-Bianchi Linnet flown by Neville Duke. Powered by a 90 h.p. Continental engine, this prototype made its first flights from Fair Oaks and is now undergoing flight testing. Selling price of the Linnet is quoted as £2,000. "Flight" photographs

A Scout B, photographed at the Royal Aircraft Factory, Farnborough.

THE BRISTOL SCOUT

HISTORIC MILITARY AIRCRAFT No. 18 PART I By J. M. BRUCE, M.A.

THE author desires to record his gratitude to the Bristol Aeroplane Co., Ltd., and in particular to C. H. Barnes of Bristol Aircraft, Ltd., for the assistance they have given in the preparation of this history.

IN that excellent work by R. Dallas Brett, *The History of British Aviation, 1908-1914*, several pages are devoted to a description of the aircraft and aero-engines exhibited at the fifth Aero Show, which opened at Olympia on March 16, 1914. In the passage describing the tractor biplanes, these paragraphs appear:—

"The *clou* of the show was the other single-seat Scout, which appeared on the Bristol stand. This delightful little aeroplane was closer to the Sopwith Tabloid design than the Avro Scout. Its span was only twenty-two feet, and its length nineteen feet nine inches. Its maximum speed with an 80 h.p. Gnôme was 94 m.p.h. and it weighed only 616 lb empty, and carried a useful load of 340 lb. A curious wing section, designed by M. Coanda, was used, in which a sharp depression occurred in the camber of the underside. Lateral control was by double-acting ailerons on both top and bottom wings. The machine stalled at 44 m.p.h., so that it could not be said to be so efficient as the Sopwith Tabloid, which carried two people at 92 m.p.h., and stalled at only 37 m.p.h. All the same, the Bristol Scout was a very fine aeroplane indeed, and a worthy rival of the famous Tabloid. It was a great pity that the latter was not exhibited at Olympia so that the two designs could be closely compared.

"It was obvious that the example of Messrs. Sopwith and Sigrist had spurred the imagination of the other English designers, and it was extraordinarily satisfactory to see that, in the Tabloid and the Bristol Scouts, we had two machines, of a new type altogether, which could beat the all-round performance of any foreign aeroplane in the world. With the production of these two little aeroplanes Great Britain stood on the threshold of wresting the supremacy in aircraft design and construction from the French."

Nowhere in Mr. Dallas Brett's book does the name of Frank Sowter Barnwell appear. Even an early note on the Barnwell monoplane of 1911 manages to mention only his brother Harold, who later became a celebrated pilot. But the little Bristol single-seater that was exhibited at Olympia in 1914 was designed by Frank Barnwell and was the first real indication of his genius as an aircraft designer.

He had been born at Lewisham on November 23, 1880. In the following year his parents moved to Glasgow, and in 1889 his father, Richard Barnwell, became managing director of the Fairfield Shipbuilding and Engineering Co., Ltd., of Govan. Frank Barnwell was educated at Fettes College, Edinburgh, and at Glasgow University. He served a six-year apprenticeship with the Fairfield company from 1898 to 1904, and took his degree of B.Sc. in engineering in March, 1905. He shared with his brother Harold a practical interest in aviation. As early as 1900 they built a biplane that was fitted with a 5 h.p. Peugeot engine; woefully underpowered, it failed to fly.

After graduating, Frank Barnwell spent a year in the U.S.A., working in the hull-draughting department of an American shipbuilding firm. He returned to Scotland in 1907 and went to Stirling to join Harold and another, younger, brother in their Grampian Motor and Engineering Co., Ltd. In 1908 the brothers produced a parasol monoplane powered by an engine designed by Harold; and in the following year they built and flew a large canard biplane that had a Humber Tourist Trophy engine driving two pusher propellers by chains. This biplane had a bicycle form of landing gear, identical in principle to that used on some present-day aircraft; its struts were of streamline section; and bracing was by steel tape instead of cable in order to reduce drag. The Barnwell biplane was badly damaged on its first flight on July 28, 1909. It was repaired, and tested again on September 8 at Causewayhead but damaged its undercarriage. On the following day, piloted by Harold Barnwell, it rose to a height of 25 feet but stalled, crashed, and was again extensively damaged.

Rather more success was enjoyed by the Barnwell monoplane of 1910, a pretty little aircraft powered by a water-cooled horizontally opposed twin-cylinder engine, designed by Harold Barnwell, that gave 40 h.p. The monoplane won a prize awarded by the Scottish Aeronautical Society.

In 1910 Frank Barnwell returned to shipbuilding for a short time, but the lure of aviation was strong and in December 1911 he joined the British and Colonial Aeroplane Co., Ltd., of Bristol, as a draughtsman. His brother Harold went to fly at Brooklands, where he gained his R.Ae.C. pilot's certificate on September 3, 1912; he later became one of the best-known pilots of his time.

When Frank Barnwell joined the British and Colonial company there was no person in the firm who was designated as chief designer. Up to the end of November 1911 the company had built some 66 aircraft which had been designed by various individuals: Challenger, Grandsiegne, Prier and Gordon England had all tried their hands. Barnwell's first task at Bristol was a remarkable one.

A naval officer, Lt. C. D. Burney, R.N. (later Sir Dennistoun Burney), had produced proposals for an aeroplane that could be carried aboard submarines. The basic idea anticipated by some seven years such aircraft as the German Hansa-Brandenburg W.20 and Roland U.1. The Burney aircraft itself was a revolutionary conception, but could hardly have been realized with the techniques and materials of its day. Its inventor proposed that it should be an inflatable aeroplane made of rubberized fabric; when deflated it was to be stowed in a small container in the submarine. For undercarriage it had three long legs, each of which bore a set of hydrofoils, and there was a marine propeller between the main legs. The aircraft was to be accelerated by means of the marine propeller alone until the hull had risen on to the lowest hydrofoil;

Scout A in its original form, with Harry Busteed.

THE BRISTOL SCOUT . . .

then, with hull clear of the water, the pilot was supposed to engage the airscrew and take off. Lt. Burney interested the British and Colonial Aeroplane Co. in his ideas in October 1911.

The Admiralty was also interested in the project and required that its development should be carried on in secrecy. The cottage that was No. 4 Fairlawn Avenue was therefore set aside as a special drawing office for the work. It was designated "X" Department by the firm, and Frank Barnwell was placed in charge of it just after Christmas 1911. His responsibility was the translation of Lt. Burney's ideas into a practical aircraft. In this task he was assisted by Mr. Clifford W. Tinson, who joined him on January 4, 1912. That development work is not, however, relevant to the history of the Bristol Scout.

The experiments with the Burney hydrovane aircraft were abandoned in September 1913. By that time the British and Colonial company had a chief designer in post: he was Henri Coanda, who had joined the firm in March 1912. At no time, however, did Coanda have any control over "X" Department: Barnwell and Tinson pursued their activities independently of the Filton House drawing office. This might have been because "X" Department's work was secret and Coanda was not a British subject; but even when the Burney experiments ceased, Barnwell and Tinson retained their independence.

Coanda designed several aircraft for the Bristol company, the best-known being the monoplane that participated in the British Military Trials of August 1912, and the T.B.8 biplane. The latter type was supplied to the R.N.A.S. and R.F.C. in small numbers.

By 1912 air racing was an established and immensely popular feature. In that year the Gordon Bennett trophy was won in spectacular fashion by France: the Deperdussin racing monoplanes flown by Vedrines and Prevost completed the course at average speeds of 105 m.p.h. and 103.6 m.p.h. respectively. In the following year, within days of the cessation of the Burney experiments, the Gordon Bennett contest was won by Prevost in a 160 h.p. Deperdussin at an average speed of 124.5 m.p.h.

The British and Colonial Aeroplane Co. built several racing aircraft before Coanda joined them. In the summer of 1913 he began to work on the design of a single-seat high-speed monoplane, and its construction was put in hand with the Bristol works sequence number S.N.183. Before long it became obvious that the designed weight would be exceeded; S.N.183 was abandoned in November, its fuselage still unfinished.

No adequate explanation has ever been given of the connection between the Coanda-designed S.N.183 and the tiny Barnwell-designed single-seat biplane which emerged in February 1914. It has been said that the incomplete fuselage of S.N.183 was turned over to Frank Barnwell with authority for him to design a new aircraft round it; but the truth is that his single-seater owed nothing to the Coanda design. While work was proceeding on the little biplane it retained the works number S.N.183, however —a fact which, coupled to the ostensible "development" of the Coanda fuselage, suggests that the Bristol management may have wished to test Barnwell's capabilities as a designer without giving offence to Coanda. (A fact which is probably relevant is that Coanda's father was Rumanian war minister at that time, and the company supplied at least thirteen aircraft to Rumania.)

The new single-seat biplane had a humble beginning. The design calculations were made by Barnwell in a penny exercise book, and all the drawings were produced by him and Tinson in a manifold book. Simple carbon copies of the drawings were sent to the construction shops, and the aeroplane was quickly built. When completed it was given the new works sequence number S.N.206.

The little Barnwell single-seater was in the same category as the Royal Aircraft Factory S.E.2a and the Sopwith Tabloid. Its diminutive size quickly earned it the popular appellation of Bristol Baby biplane, but it had not been long in existence before it was being referred to as the Bristol scout biplane.

The first Bristol Scout was characterized by clean and simple lines, and was obviously a potential challenger to the Sopwith Tabloid, which had made its debut some three months earlier. Of the two, the Bristol was slightly the smaller: its single-bay wings spanned only 22ft and their area was 161.5 sq ft; loaded, it weighed a little under 960 lb. The airframe was of wood; internal wire bracing was fitted to fuselage and mainplanes; and the external interplane bracing was by cables. An advanced feature of the design was the use of double-acting ailerons on upper and lower wings. This enabled the Bristol's mainplanes to be braced much more satisfactorily than those of nearly all its competitors, which had warping wings.

The slender lines of the fuselage were emphasized by the engine cowling. The 80 h.p. Gnôme was partly enclosed within a cowling that was open at the bottom and did not extend below the level of the front ends of the bottom longerons. Aluminium panels covered the fuselage from the nose to the back of the cockpit; behind that point fabric was used. A fixed strut-braced tailplane and divided elevator were fitted; they were made of steel tubing, as also was the balanced rudder. A simple vee-type undercarriage of narrow track (3ft 3in) was used, and the wheels had no fabric covering.

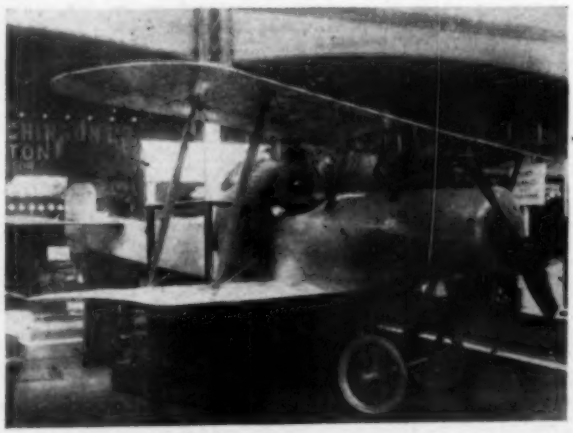
Such was the Bristol Baby tractor biplane which, on February 23, 1914, went to Larkhill on Salisbury Plain for its trial flights. These were made by Harry Busteed, whose enthusiasm was instantly fired by the excellent performance of his new mount. After a brief acquaintance with the little Bristol, Busteed attained a speed of 95 m.p.h. on it and showed its initial rate of climb to be 800ft/min. Such was his attachment to the aircraft that another of its early names was "Busteed's machine."

From Larkhill the Bristol Scout was sent to Olympia, where it was exhibited in company with Coanda's latest design, the G.B.75 two-seater. It was not the only single-seater scout in the exhibition, for the Avro 511 was also shown; the Bristol was the simpler and more conventional of the two.

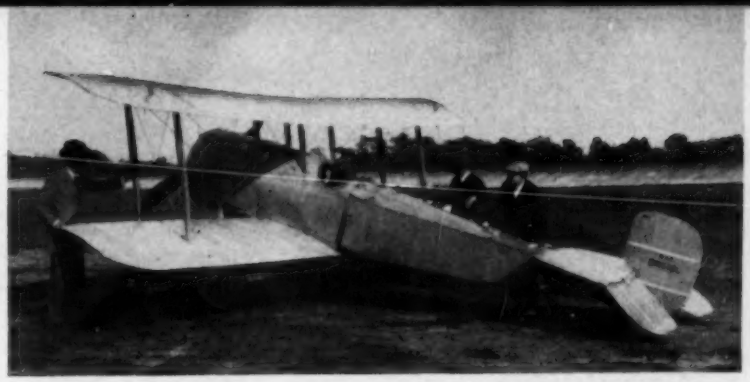
Test-flying at Larkhill was resumed after the Aero Show closed, and late in April 1914 the Scout was sent back to Filton for modification. New mainplanes of greater area were fitted; their chord was increased by 6in, their span by 2ft 7in, and they had more dihedral. The ailerons were of slightly shorter span and had an intermediate false spar to which were attached the inter-aileron cables. On the original ailerons these cables had been attached to the trailing-edge members. The rudder area was increased slightly, but the surface retained its characteristic shape. A new engine cowling was fitted: it was one of the earliest British examples of the completely circular cowling with frontal aperture which was to characterize so many rotary-powered aircraft of the 1914-18 War. A further refinement was the application of fabric covering to the wheel discs.

These modifications greatly enhanced the appearance of the Bristol: the machine now seemed better proportioned, and was one of the prettiest of its period. Little time was lost in making the changes, for the modified Scout underwent the official performance tests at Farnborough on May 14, 1914. Flown by Harry Busteed, it proved to have a maximum speed of 97.5 m.p.h. and to stall at 40 m.p.h. After the Farnborough tests, Busteed flew the Bristol to Brooklands, where he and the aircraft remained for several days.

Busteed demonstrated the Scout's capabilities at Brooklands. While there, it was pitted, in a handicap race, against the landplane conversion of the Sopwith Tabloid which won the 1914 Schneider Trophy contest. Despite the Sopwith's greater power, the Bristol Scout was beaten by a few seconds only.



Scout A in its original form, at Olympia in 1914.



Modified Scout A with 80 h.p. Gnôme engine.

The 1914 Aerial Derby promised to be a contest of unusual interest, for the field included two Sopwith Tabloids, the Bristol Scout, and the Avro 511 Scout. This, it seemed, was an opportunity to compare the capabilities of the fast little single-seaters. The race was originally arranged to take place on May 23, but on that day the weather was unsuitable; it was, moreover, a day on which British aviation lost a brilliant pilot who was to have participated in the Aerial Derby. Flying the new Morane-Saulnier racing monoplane which would have been his mount in the contest, Gustav Hamel had taken off from Hardelot at 12.15 p.m., bound for Hendon. Neither he nor his aircraft were ever seen again.

The Aerial Derby was postponed for two weeks, but neither the Bristol nor the Avro Scout took part in it. The Avro had been much modified since its appearance at Olympia in March; it was tested by F. P. Raynham at Brooklands on the eve of the race, but its new undercarriage collapsed and the aircraft was badly damaged. The day of the contest, June 6, was one of dangerously bad visibility. The Bristol was to have been flown by S. V. Sippe, but the British and Colonial Aeroplane Co. did not wish to hazard the aircraft, and forbade him to leave Brooklands.

Eleven pilots took off into the haze, ninth man away being Lord Carbery on his Morane-Saulnier monoplane. He and seven others, including the two Tabloids, had to retire from the race. Lord Carbery had been favourably impressed by the lines of the Bristol Scout, and on June 8 he asked Mr. Sippe for permission to fly the machine. He was instantly so captivated by the little biplane's delightful flying qualities and so impressed by its speed that he asked whether he might be allowed to buy it. The British and Colonial company agreed to the sale, as they had begun to build two more Scouts, and Lord Carbery became the owner of S.N.206 on June 10.

He replaced the Gnôme engine by an 80 h.p. Le Rhône taken from his Morane-Saulnier. A wide slot was cut round the lower part of the engine cowling. For three runs in opposite directions over a quarter-mile course the aircraft returned an average speed of 100 m.p.h.

Lord Carbery lost no time in entering his Scout for the next two contests in the British aviation calendar. The first of these was the Hendon - Manchester - Hendon race of June 20, in which Harry Hawker was scratch man on the 100 h.p. Sopwith Tabloid; Lord Carbery's handicap was 24 min 42 sec. Bad visibility marred this race as it had the Aerial Derby, and other factors again prevented a real duel between the Bristol and the Sopwith. Hawker became ill and had to abandon the race; Lord Carbery, still unfamiliar with his new aircraft, landed across wind at Castle Bromwich, tipped his Scout up on its nose, and broke the undercarriage and port lower mainplane. The Scout was returned to Filton for repair and was airworthy again by July 7, just four days before the London - Paris - London race, the second of the two contests for which Lord Carbery had entered his new aircraft. This race, which was sponsored by the International Correspondence Schools, was a fitting climax to the pioneer period of British aviation. It was the first contest to connect the British and French capitals, and its course of 508½ miles (actually Hendon - Buc - Hendon) was the longest of 1914. Fourteen entries were received, and Lord Carbery's Bristol was allotted No. 1 as racing number; he was scratch man.

Early mist caused the start of the race to be postponed by one hour until 7.30 a.m. Only six entrants made effective starts, last away in the racing sequence being Lord Carbery at 8.10 a.m. (Renaux made a false start at 7.35 a.m., and did not leave until 8.23 a.m.). Carbery was carrying five hours' fuel; his Le Rhône was not running satisfactorily and would give only 1,100 r.p.m.; and *Flight*'s reporter recorded that "he got away in a very shaky manner." The style of Lord Carbery's departure was in no way aided by his struggle, during take-off, to straighten the throttle lever which he had accidentally bent when getting into the aircraft. The overloaded Scout had to circle Hendon three times to gain height, but Lord Carbery set off determinedly in pursuit of Carr, Brock, Noel and Garros.

The Bristol passed over Boulogne at 10.19 a.m. and reached Buc at 12.04 p.m. Exactly two hours later Carbery took off from Buc; he crossed the French coast at Hardelot at 4.55 p.m. Only one of his Scout's two tanks had been filled at Buc, however, and over the Channel he ran out of fuel. He had no choice but to ditch, but fortunately a tramp steamer was in sight. Carbery brought the little Bristol down on the water as near to the steamer as possible and was soon picked up, dry and uninjured.

His aircraft was not so fortunate. The well-intentioned salvage efforts made by the tramp's crew proved to be over-robust: the Bristol's fuselage broke, and all but the Le Rhône and its bearers fell back into the waters of the Channel and was lost. Lord Carbery was transferred to H.M.S. *St. Vincent* and landed at Folkestone.

Soon after the first Bristol Scout went to its untimely grave in the waters of the Channel, this order was issued from the Home Office:—

"In pursuance of the powers conferred on me by the Aerial Navigation Acts, 1911 and 1913, I hereby make, for the purposes of the safety and defence of the Realm, the following Order:—

"I prohibit the navigation of aircraft of every class and description over the whole area of the United Kingdom, and over the whole of the coastline thereof and territorial waters adjacent thereto.

"This order shall not apply to Naval or Military aircraft or to aircraft flying under Naval or Military orders, nor shall it apply to any aircraft flying within three miles of a recognized aerodrome.

R. McKenna,
One of His Majesty's Principal Secretaries of State."

An era had ended.

* * *

In that July of 1914 it had become apparent that war with Germany was inevitable. The employees of the British and Colonial Aeroplane Company were recalled from their holidays and set to work on the production of fifty B.E.2cs and on the overhaul and modification of available aircraft. The work on the two Scouts which had been laid down in April was accelerated, and on August 21 and 23 they were delivered to Farnborough for use by the Royal Flying Corps. They were given the official serial numbers 633 and 634.

These two machines were designated Bristol Scout B,* the original machine being regarded as the Scout A. In appearance they were very similar to the final form of the Scout A, but were fitted with wing-tip skids under the lower mainplanes in line with the interplane struts. The track of the undercarriage of Lord Carbery's Scout had been increased when it was repaired after its Castle Bromwich mishap; the undercarriage of the Scouts B appeared to be of similar dimensions. On the two later machines all flying wires were duplicated. The engine was the 80 h.p. Gnôme; the cowling had a smaller and peculiarly depressed frontal aperture, but retained the six chordwise stiffening ribs that had appeared on the modified Scout A.

The Scouts B were sent to France in September 1914 and arrived there during the Battle of the Marne. Col. L. A. Strange has recorded that one of the Bristols was flown by 2nd Lt. Gordon Bell at one time. That may have been soon after the aircraft's arrival in France, when they were on the strength of the Aircraft Park. They later went to squadrons, however, for in his book *Five Years in the R.F.C.* Maj. J. T. B. McCudden, V.C., D.S.O., M.C., M.M., noted:—

"Towards the end of September two Bristol Scouts fitted with 80 h.p. Gnômes, arrived from England. One was flown by Lieutenant Cholmondeley, of No. 3 Squadron, and the other by Major Higgins, of No. 5 Squadron.

"These 'Scouts' were far ahead in performance of anything the Germans had in the air at this time, but the trouble was that no one had accurately foreseen developments as regards fitting machine-guns so that they could be used with any effect from single-seater machines.

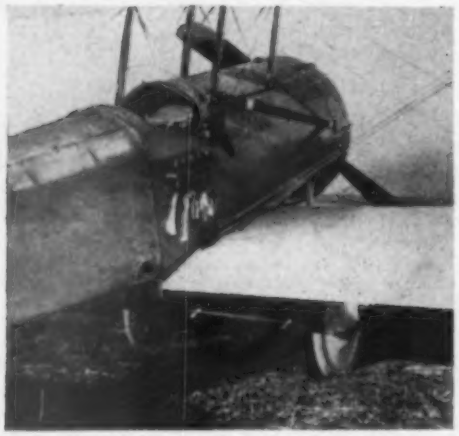
"The Bristol in No. 3 Squadron was fitted with two rifles, one on each side of the fuselage, shooting at an angle of about 45 deg in order to miss the air-screw."

Similar "home-made" armament was fitted to No. 5 Squadron's Bristol Scout, which had been fitted with a transparent windscreen at some time. A Lee-Enfield rifle with stock removed was attached to the starboard side of the fuselage, firing outwards and downwards to clear the propeller. A Mauser pistol was carried in an external holster on the starboard side of the cockpit, and an external rack held five rifle grenades to each of which rags were tied to act as stabilizers during the missile's fall.

Those two Bristols won the acclaim of their pilots, for their ineffective armament was no more ineffective than that of their contemporaries, and combats were few and experimental. Their speed and rate of climb earned them the nickname Bristol "Bullet," a name which later Bristol Scouts were to share with fast single-seaters of other makes. One of the Bristol Scouts B had an early combat success when its pilot, Lt. F. V. Holt, forced down an enemy two-seater after a revolver duel.

The fate of the two little Bristols is not known, but their service

**The designation Scout B is introduced into the narrative at this point to facilitate reference. It is doubtful whether it was contemporary with the two aircraft concerned: it seems more probable that the designations Scout A and Scout B were not applied until the appearance of the Scout C.*



(Left) Scout B of No. 5 Squadron, R.F.C., showing the armament. (Right) Modified Scout A with 80 h.p. Le Rhône engine and bearing Lord Carbery's racing number "1" for the Paris race.

THE BRISTOL SCOUT . . .

in France was relatively brief: no Bristol Scouts were with any operational R.F.C. unit by March 10, 1915. The accomplishments of the Scouts B must have sufficed to prove the value of fast single-seaters to the War Office; for, despite that Department's pre-occupation with the B.E.2c, an order for twelve Bristol Scouts was placed with the British and Colonial company in November 1914. The contract (No. A.2824) was dated November 5; the Scouts had the official serial numbers 1602-1613, and their works sequence numbers were 450-461.

Production of these Scouts was undertaken at the Brislington works of the Tramways Company, and they were closely followed by two dozen more ordered by the Admiralty. Serial numbers were 1243-1266, the works numbers 462-485.

These production machines were powered by the 80 h.p. Gnôme engine and were well-nigh indistinguishable from the Scouts B. A new type of engine cowling was used: it had no external stiffening ribs and its frontal aperture was surprisingly small. The shape of the cockpit opening was modified, the top decking in front of the cockpit was deepened, and the fuselage sides were aluminium-covered only as far aft as the forward centre-section struts; abaft that point the top decking was of plywood, and extended for a greater distance behind the cockpit than had been the case on Scouts A and B.

This, the first true production variant, was designated Bristol Scout C. The machines ordered for the R.F.C. were delivered in March 1915, whereupon a further seventy-five were ordered. These were 4662-4699 and 5291-5327, and were built at Brislington.

The Filton works were fully occupied on the production of B.E.2cs for the War Office. No development or design work was being undertaken, and soon the British and Colonial design team began to disperse. Coanda went back to Rumania, Clifford Tinson joined the Air Department of the Admiralty, and Frank Barnwell was commissioned in the R.F.C. Barnwell took his pilot's certificate (No. 986) on December 9, 1914, at Brooklands, and was given his R.F.C. pilot's badge at the Central Flying School in March 1915. He was posted to No. 12 Sqn., then on Home Establishment, with which he flew until his release on indefinite leave in August 1915, when he returned to the British and Colonial Aeroplane Co.

By the time of Barnwell's return to Bristol, the production Scouts had been in service for some months. One of the first operational units to have a production Bristol Scout was No. 4 Squadron, which had one on its strength on May 9, 1915. The Order of Battle of the R.F.C. on September 25, 1915, shows that there were nine Bristols with operational units of the R.F.C. in France: on that date Squadrons Nos. 2, 3, 5, 6, 7, 10 and 12 had one each; No. 8 had two.

In earlier articles in this series it has been noted that it was the practice of the time to give each squadron one or two single-seat scouts, principally to act as escorts to the two-seaters which formed the main equipment of every operational unit then in France. Thus it was that no single squadron was equipped throughout with Bristol Scouts; indeed, it seems improbable that any one of those in France had more than three.

In July 1915 No. 6 Sqn., R.F.C., had on its strength two Bristol Scouts and numbered among its officers one Capt. Lanoe George Hawker, who had been awarded the D.S.O. for his daring attack of April 19, 1915, on the enemy airship sheds at Gontrode. On that occasion he flew a B.E.2c. On the evening of July 25 he took off in a Bristol Scout on a patrol. Over the Ypres salient Hawker encountered a German two-seater which he attacked; the enemy dived steeply away. Continuing his patrol, he attacked another two-seater over Houthulst forest; this machine he forced down with a damaged engine. Later in the same flight Hawker attacked a third German machine, an Albatros two-seater which he found at 11,000ft over Hooge. The Albatros was observing for an enemy battery. Hawker attacked out of the sun and, after a brief exchange of shots, sent the two-seater down in flames; the enemy observer fell out as it turned over at 10,000ft.

For that action Hawker was awarded the Victoria Cross, the third V.C. to be won by a member of the flying services and the first awarded for aerial combat. It was gazetted on August 24, 1915.

Some uncertainty surrounds the nature of the armament of Hawker's Bristol Scout. Several sources have stated that it consisted of no more than a single-shot cavalry carbine that was stayed to the upper starboard longéron at an outward angle, thus avoiding the airscrew. In *Recollections of an Airman*, however, Lt-Col. L. A. Strange recorded that Hawker ". . . flew a Bristol Scout that carried a Lewis gun" (but the reference was general rather than specifically to the V.C. action). The account of Hawker's great action of July 25 which is given in *The War in the Air*, Vol. II, page 142, includes the statement: "He got off a drum of ammunition before the enemy dived steeply away"; yet that same account finds it necessary to record that "All three German aeroplanes which Hawker attacked were armed with machine-guns," an observation which would hardly have been necessary if Hawker's aircraft had a machine-gun.

It would not be surprising if Hawker had in fact fitted a machine-gun to his Scout, for A. J. Insall has written: "If a gun had to be fitted in an awkward place on a machine, and no one could hit it off, Hawker would sit up all night and design an engineer's device. . . . Among his other qualifications, practical mathematics and inventiveness occupied an important place. . . ."

Because they were so few in number, and because their flying qualities were so enchantingly different from those of the two-seaters that equipped the R.F.C. squadrons, the Bristols were flown only by selected pilots. In *Flying and Soldiering*, R. R. Money wrote of Capt. G. A. K. Lawrence, Flight Commander of "A" Flight, No. 12 Sqn., that he

". . . was very annoyed because he was considered too ham-fisted to fly the squadron Bristol Scout. The Bristol was a delightful little machine with an 80 h.p. Le Rhône engine. One was allotted to each B.E. squadron and was a cause of infinite jealousy among pilots. It usually became the perquisite of the senior Flight Commander, but if he was one of those rare birds who not only *was* ham-fisted, but knew it, there was a chance that the machine might get into useful hands."

That was in September 1915. Lawrence, who in Money's words "was a terrific fire-eater," was later the C.O. of No. 70 Sqn. when it first brought its Sopwith 1½-Strutters to France in 1916. He ultimately flew single-seat scouts, but met his death at Netheravon when his Vickers F.B.19 crashed.

I.A.S. MEETINGS

FORTHCOMING meetings announced by the Institute of the Aeronautical Sciences include a joint one with the Canadian Aeronautical Institute (Ottawa, Oct. 7-8); National Specialist Meeting on Dynamics and Aeroelasticity (Fort Worth, Texas, November 6-7); Wright Brothers Lecture, by Maurice Roy on *French Aeronautical Research* (Washington, D.C., December 17); and 27th Annual Meeting (New York, January 27, 1959).

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Fare Differentials

WHY all this argument over discounts and premiums on turbo-prop and jet travel? If it is agreed that a fare differential is a necessity, why not be honest and take the total operating cost, add an agreed percentage of profit—which should be the same in each case—and thus arrive at an equitable fare?

Bickley, Kent. F. E. H. JACKSON.

[Who shall be the arbiter of honesty in the estimation of jet and turboprop operating costs?—Ed.]

Turboprop Conversions

I AM surprised that in his letter to you (*Flight*, September 5), John Rodgers did not suggest entrusting the re-engining of the DC-7C to Napier. This firm has an engine—the Eland propeller turbine—perfectly suited to the job, and is fully conversant with the problems of conversion, having fitted Elands to no fewer than four piston-engined aircraft.

Turboprop conversion is the obvious remedy for the DC-7C's troubles, and the merits of the case could quickly be proved if an airliner of this type were made available to a firm with a wealth of conversion experience and a type-tested engine ready for immediate installation. Basically, the DC-7C is an airliner of great potential merit and it would be a tragedy if, for the want of a little enterprise and the expenditure of a comparatively small sum of money, it died a premature death.

Twickenham, Middx. F. J. BUTLER.

YOUR correspondent Mr. Rodgers appears to have designated the 3,500 e.h.p. Napier Eland engine to Convair conversion only, but surely here is ample power for the DC-7 series. It has been type-approved both by the A.R.B. and the C.A.A. and is already in production.

If airline operators are to remedy their DC-7 series losses, immediate action is necessary; and if, as Mr. Rodgers suggests, a change of B.O.A.C. and Government policy is indicated the Eland would appear to be by far their best bet.

Orpington, Kent. G. H. CLIFFORD.

The Croydon Closure

IT is well to mark that despite several reprieves, Croydon Airport is to close on December 31, 1958, and that by next spring the construction of factories and council houses may well be under way.

This is no news to anyone connected with aviation either in this country or abroad, but we should pause for a moment to comprehend fully what is being done by a Ministry, one of whose functions under the Air Navigation Acts is to provide facilities for flying.

It is proposed to destroy (1) an airfield with a landing or take-off run of 1,600 yd which, due to its type of soil, has the advantages of all-weather operation enjoyed by airfields with runways costing hundreds of thousands of pounds, plus their associated heavy maintenance costs. Croydon, in fact, draws a not inconsiderable revenue from its landing area by selling the grass which is cut. (2) Substantial two-storey airport buildings with Customs hall, refreshment facilities and a residential hotel. (3) Hangarage at present occupied by 80 aircraft (estimated accommodation for a total of 150 available) plus stores buildings, fire station and petrol storage. (4) A weather record which, as far as cloud base is concerned, is the best in the London area. (5) Customs facilities on the S.E. corner of London for light, non-radio and charter aircraft who can clear in or out of the London Control Zone for the Continent, with the least inconvenience to themselves or the control authorities under I.M.C. weather conditions. (6) A home for three flying clubs, four flying groups, two charter companies, numerous executive and private aircraft plus several overhaul and manufacturing organizations. In fact, with its present constitution, there are few flying requirements which cannot be met by one or other of the airport organizations.

The arguments against the retention of Croydon as a secondary airport—i.e., control difficulties, noise, insufficient traffic—have all been demolished but the Ministry's decision remains.

In the six months of operation ending June 30, 1958, the total aircraft movements were 32,676 (June being 7,310). Further, in July and August (when Gatwick was also in operation) the movements were 7,050 and 8,464 respectively—not bad for a redundant airport.

All the foregoing activities will cease on December 31 and the various organizations will have to make the best arrangements they can to carry on elsewhere—or go out of the aircraft business.

This letter only states facts that are known to all concerned, but it may be as well to realize that this substantial asset of British aviation has all but ceased to exist without any valid reason being advanced for its destruction.

Croydon Airport, Surrey. R. J. WEBB, Vendair (London), Ltd.

Upstart Words

I HAVE read with much interest Roger Bacon's comments on the English usage of the "United Statesers" and agree that they should be taken to task for their murderous habits. Fifty per cent of the papers examined as part of my work are American and it is a hard job reading through the long-winded sentences and stumbling over their new long words which they have substituted for the original "Britisher" ones. Many of the reports contain sentences made up of words of ten letters or more and include also one or two new words.

The other day I read "un-cooperate surveillance of non-categorised and random operational movements within the subject areas of surveillance." And how about this: "These differences are statistically superimposed on other differences associated with random meteorological photometric/psychophysical variations."

Further, I find that the word "start" is too easy for them; they prefer "activate"; possibly their word looks more "technacious."

I recently had a request for assistance in getting "acreditisation to U.K. industry."

London, N.W.2. L. F. E. COOMBS.

Apochryphilia No. 1

I find it quite hard,
As I sit in Dean's yard,
Said the noble Lord T.
Of the A.T.A.C.,
To stifle a smile
At the infinite guile
And the quaint perorations
Of the Corporations
And their logic even stranger
Than the dog used in the manger.

CELESTIS.

FORTHCOMING EVENTS

Sept. 22-27. A.C.I.M.A. Third European Aeronautical Conference, Brussels.
Sept. 25-26. Aerodrome Owners' Association: Annual Conference.
Sept. 26-29. Austrian Aero Club: Innsbruck Rally.
Sept. 27-28. Armstrong Siddeley Flying Club: Tipsy Weekend, Baginton.
Sept. 27-29. Surrey Flying Club: Fiers Rally.
Oct. 1. Kronfeld Club: American films.
Oct. 3. Helicopter Association: "All Weather Helicopter Systems," by W. Gerstenberger.
Oct. 7-8. Canadian Aeronautical Institute: Joint I.A.S./C.A.I. Meeting, Ottawa.
Oct. 8. Kronfeld Club: "OSTIV," by Alan Yates.
Oct. 9. R.Ae.S.: The Fourteenth British Commonwealth Lecture, by J. C. Floyd.
Oct. 9. Society of Instrument Technology: "Aircraft Flight Simulators," by Dr. A. E. Cutler.
Oct. 10-11. College of Aeronautics, Cranfield: Open Days.
Oct. 10-12. Australian Women Pilots' Association: a.g.m., Sydney.
Oct. 11-12. British Women Pilots' Association: Flying Weekend, Ramsgate.
Oct. 16. R.Ae.S. Graduates' and Students' Section: "The Fatigue of Aircraft," by Major P. L. Teed.
Oct. 16-17. British Interplanetary Society: Space Medicine Symposium and Twenty-fifth Anniversary Dinner.
Oct. 17. Fair Oaks Aero Club: Annual Dinner and Dance.

R.Ae.S. Branch Fixtures:—Sept. 30, *London Airport*, "The Boeing 707," by M. Pennell. Oct. 6, *Henlow*, "Mixed Powerplants," by M. J. Brennan. Oct. 7, *Boscombe Down*, "Propulsion Systems for Space Travel," by A. V. Cleaver. Oct. 8, *Gloucester*, "History of the Supermarine Works," by A. N. Clifton; *Manchester*, "Problems of Supersonic Flight," by L. P. Twiss; *Swindon*, "The Work of the R.A.E.," by M. B. Morgan; *Weybridge*, "Physiological Aspects of High-Performance Flight," by Dr. K. G. Williams. Oct. 13, *Glasgow*, Graduates' and Students' Section, Opening Meeting. Oct. 15, *Bristol*, Presidential Address; *Coventry*, "Digital Computers," by R. F. King. Oct. 20, *Glasgow*, "Propulsion Systems for Helicopters," by Dr. A. W. Morley; *Henlow*, "Guidance and Control," by L. H. Bedford. Oct. 21, *Luton*, "Fatigue Testing of the Fokker Friendship," by E. J. van Beek. Oct. 23, *Bristol*, film show. Oct. 29, *London Airport*, brains trust; *Weybridge*, brains trust. Nov. 4, *Luton*, "Guided Flight," by L. H. Bedford. Nov. 12, *Manchester*, "Digital Differential Analysers," by K. V. Diprose. Nov. 18, *Luton*, Discussion Evening. Nov. 19, *Weybridge*, "Training of a Production Engineer for the Aircraft Industry," by Professor J. Loxham. Nov. 21, *Luton*, Annual Dinner. Dec. 2, *Luton*, "Satellites," by E. M. Dowlen. Dec. 4, *London Airport*, "Airline Operational Flying," by Capt. W. Baillie. Dec. 10, *Manchester*, "Civil Aircraft Production," by P. Imlach; *Weybridge*, R. K. Pierson Memorial Lecture, by B. S. Shenstone. Dec. 19, *Weybridge*, Annual Dance.

Straight and Level

"IF there is any race, it is not on our part. We will put this airplane [707-120] into service when our people know how to handle it. We are not going to operate one day sooner because of any so-called race." You may have seen this remark, which was made by Mr. Harold Gray of Pan American, recorded in last week's *Flight*.

Then it must be B.O.A.C. who are jet-racing. But I am assured that no question of any race exists so far as the Corporation is concerned.

Can it be by sheer coincidence that the world's two most important air faring and air manufacturing nations are, within a few days of each other, putting their jet airliners on to the world's most competitive route—a route for which the aircraft concerned were not designed?

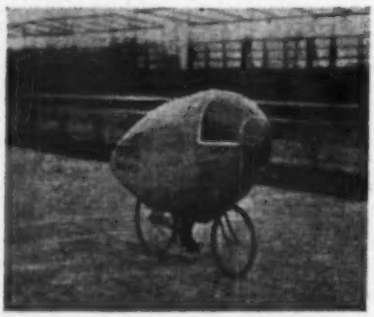
● *"Maybe you're thinking: We've licked the Yanks again!"* This is suggested by one daily paper, which goes on to declare: (1) "Whichever country introduces the first jetliner service over the North Atlantic is going to be Top Country in the airline world." (2) "Turn the government experts loose" to aid D.H. and B.O.A.C. (3) "Call in the R.A.F." (4) The Comet "will knock flat . . . all the whispering campaigns that have been aimed at it on the other side of the Atlantic."

I rang Sir Charles Boost for his comments on these remarks. Sir Charles, who has recently been appointed Grand Master of the Gunboat Association of Great Britain, responded characteristically: "If it is a question of putting the safety of passengers before licking the pants off those Yanks, I say every time let's lick the pants off those Yanks!" He then bellowed the first verse of *Rule, Britannia* into the telephone, and rang off with the cry: "Britain must win the blue riband of the air!"

● *"We think Pan American World Airways is being smart in declining to enter any race with British Overseas Airways Corp. to be the first airline to set up regular jet transatlantic passenger service,"* says the New York *Daily News*. *"Far better than 'racing' B.O.A.C. or anybody else, it seems to us, is for PanAm to take plenty of time to practise operating these new planes, with safety as the prime objective."*

I draw the attention of the New York *Daily News* to the following facts: (1) When B.O.A.C. Comet captains fly their first fare-paying passengers they will each have had a *minimum* of 1,200 hr flying jet airliners on world air routes. Some captains will have had more than 2,000 jet hours. (2) Each captain will have flown during the past four months ten transatlantic round-trips in Comet 2Es and Comet 4s, including familiarization with alternates at each end. (3) B.O.A.C. Comet fleet crews have been training and route-proving without a break for one year, more than half of it at the rate of 20 Comet hours per day.

● I assure you that I am impervious to the sort of headlines we have been reading these last few days—for example: "Britain MUST win the Battle of the Atlantic!" I do not think it can be too strongly said that the introduction of new aeroplanes into passenger service, particularly revolutionary aeroplanes like the 707, is a matter which requires the exercise of the most particular caution. Aviation, as the British have learned, is terribly unforgiving of those who set too fast a pace.



I recommend to Sir William Hildred, director-general of the International Air Transport Association, this bicycle speed-kit. Sir William's bicycle, which he says he stole 47 years ago from his 93-year-old father, is a famous one. "I can operate it at 0.1 cents per capacity ton-mile," he has estimated, expenditure being accounted to "one drop of oil." Sir William should know all about technological progress, and what it does to operating costs. Does he think this technical advance will increase or diminish his operating costs? Careful, Sir William; I shall attach a great deal of importance to your decision.

● I liked Dr. Lachmann's remark at the recent I.C.A.S. conference in Madrid (quoted, I believe, from an American magazine) that "laminar flow is always the bridesmaid, never the bride." He said he thought that the girl was now quite ready for marriage, and someone should quickly propose. "But of course," he added, "there's going to be an awful argument about the dowry."

The fly in the ointment still seems to be the fly-accretion problem. Expendable leading-edge covers may be one solution; airport disinsecticization (I think that's the word)—paid for by the airport authorities, of course—may be another.

● Pottering round one of our most famed aircraft companies the other day I espied a grey-haired ancient dishing out towels in one of the washrooms. "That gentleman," said my host, "has been here longer than anyone else—and much longer than any of the Board of directors." In U.S. firms it is usually easier to become the oldest inhabitant. I believe that the average length of service of all employees in the U.S. aircraft industry is less than five years.

● *Flight*, April 18, page 520 [in an article about differential fares]: "You pays yer money and you takes yer choice."

Mr. Peter Masefield, writing on the same subject to *The Times* of September 15: "You pays your money and you takes your choice."

Flight says "yer," Masefield says "your." But your or yer, them's my sentiments.

● Bad weather used to be blamed, logically enough, on the meteorologists. Then came atomic explosions. Now something new, I think, has been added—by Sir Alfred Munnings in a recent letter to *The Times*:—

"Atomic tests may not be the sole cause of disastrous weather. Surely part blame must be laid on the continual rending of the atmosphere by fast and faster jet planes that shatter our nerves, leaving vast vacuums and volleyings of air-filling thunder in their wake, shaking the very ground in passing. All this cleavage of air, miles above, with burstings of the sound barrier, must cause atmospheric disturbances. East Anglia, once our driest district, is now too often covered with an ominous grey ceiling of cloud. Seldom do we get fresh, sunny days as of yore. Sudden abnormal downpours happen. The noise of these hideous monsters is unbearable and killing."

I wonder whether Sir Alfred would care to comment on the proposed R.34 memorial?

● "It has never been suggested by the airlines that have sunk millions of pounds in jet aircraft that they cannot be operated profitably at existing fare levels."—*The Economist.*

● Here are my two favourite Farnborough Press-tent quotes this year—demonstrating control of situation, honesty and brevity.

1. S.B.A.C. official: *"I'm afraid I can't tell you whether and when the Russians are coming."*
   Ace air correspondent: *"They came yesterday, old boy."*
   S.B.A.C. official: *"Oh, I see."*
2. Ace air correspondent: *"Why didn't your mighty machine fly yesterday, old boy?"*
   Company P.R.O.: *"It wouldn't start."*

● Bomb hoaxes continue to be in the news. Though they are a singularly unfunny topic, I cannot resist wondering whether I shall ever read the following in my morning paper:—

"Fire engines and ambulances stood by yesterday at the Woodford airfield of A. V. Roe, Ltd., and test flights were delayed for several hours, while officials searched the company's stand-off bomb. An anonymous telephone caller had warned: 'There is an aeroplane on your bomb.'"

ROGER BACON

Dunlop Prop-Brake cuts turn-round costs!

Windmilling propellers cost time and money—passenger handling must wait and urgent engine inspection may be held up.
But vital stop-over time can be saved, simply and efficiently, by fitting the new Dunlop anti-windmill propeller brake. No bigger than a man's hand, this wonderfully efficient brake will bring the propeller of the biggest turbo-prop to a smooth and rapid standstill. Passengers can move on and off within seconds of landing.
There is an additional safety factor too. The brake cannot be applied while the plane is airborne.

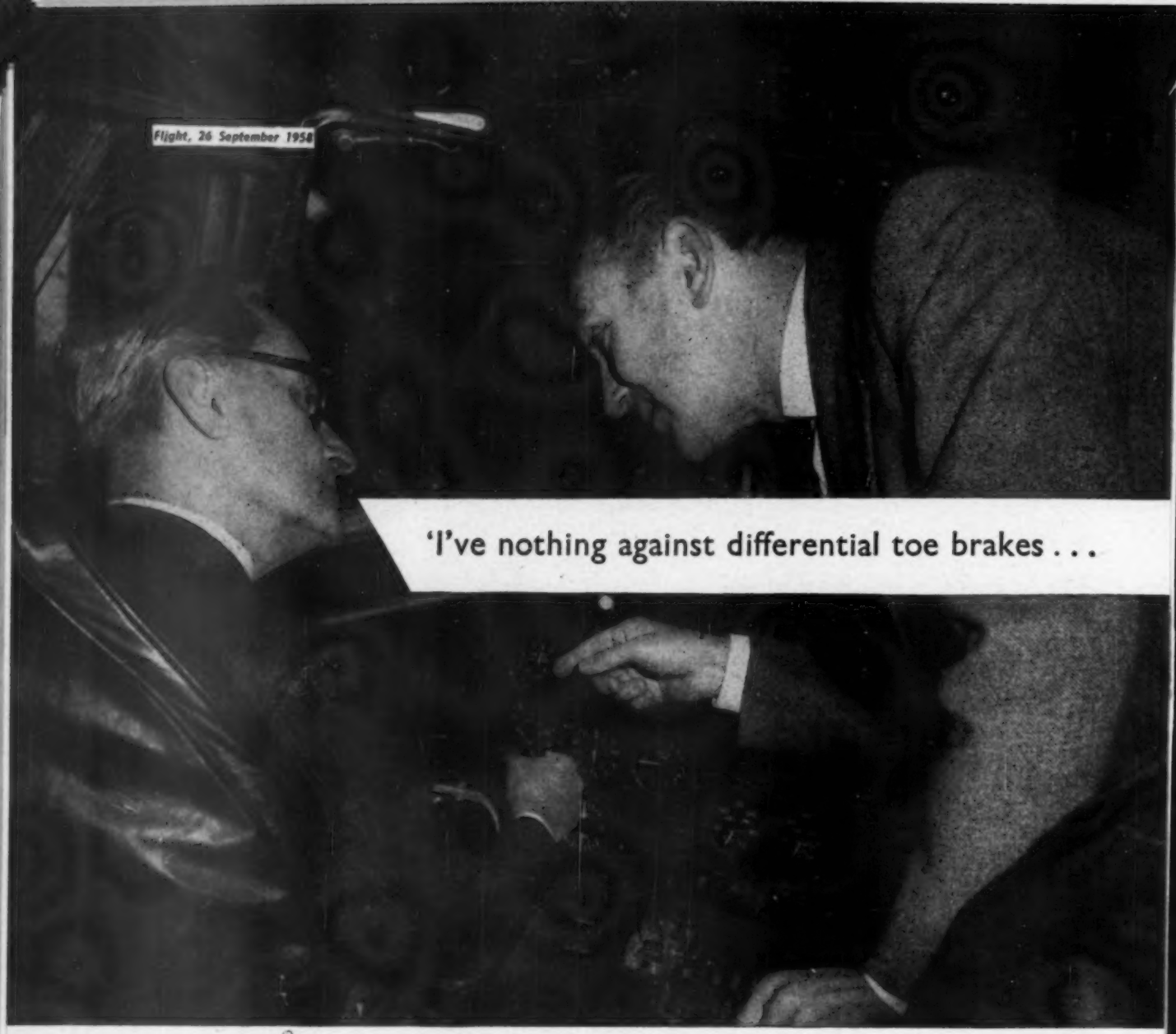
Save time and money on turn-round *with the new*

DUNLOP

'Anti-Windmill' Propeller Brake

7M 622

DUNLOP RUBBER CO. LTD. *(AVIATION DIVISION)*, FOLESHILL, COVENTRY



'I've nothing against differential toe brakes . . .

I'm just more interested in financial merits!'

To switch from the technical merits of the Viscount 810/840 to its financial advantages is to exchange one success story for another.

Both in first cost and operational economy this latest Viscount is the outstanding aircraft of its class in service. It offers medium haul operators a unique combination of speed, background experience and passenger appeal.

Yet initial cost is 50% less than any other 4-engined turbo-prop, while capacity is greater and seat mile costs are even lower than earlier Viscounts. Present cruising speed is 365 m.p.h. and in 1960 when re-engined with a more powerful version of the Rolls-Royce Dart, the aircraft will become the V840 with speed raised to 400 m.p.h.

The success of Viscounts is based on two important facts. Passengers prefer them—and they produce healthy airline balance sheets.

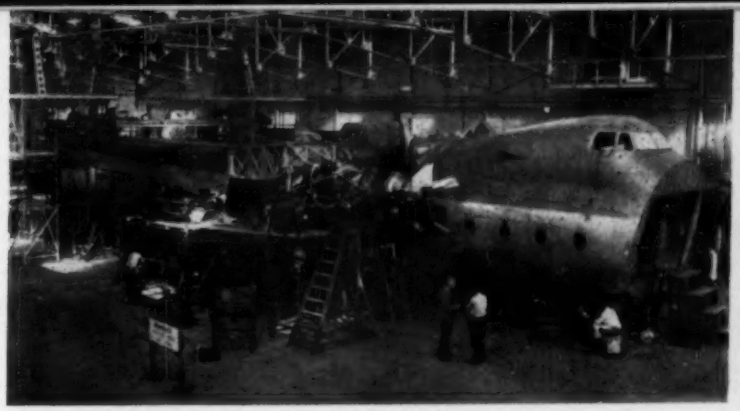
VICKERS VISCOUNT 810/840

FOUR ROLLS-ROYCE DART PROPELLER-TURBINE ENGINES

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

TGA AT575

CIVIL AVIATION



Progress with the first Armstrong Whitworth Argosy is here evident: centre-section, inboard Dart 526s, tail-booms and tail-fins are seen to be in position. First flight target-date is "before the end of the year." Meanwhile a second fuselage went into the water test-tank last Saturday. A second tank-test specimen is being prepared.

ITALY AND THE 707

AN unusual question of international air law was raised by the Italian Government's decision last week not to accept at Rome and Milan Pan American's advertised 707-120 services, which might (it was said) "lower the safety level."

This unprecedented action is certain to be regarded by the Americans as unreasonable discrimination against their jet airliner. It is most unlikely that the terms of the U.S.-Italian bilateral agreement—or indeed any air agreement between two countries—contains any provision which reserves the right of either party to ban a particular aircraft on traffic-control grounds. Such a decision may indeed be considered by the Americans as tantamount to doubting the competence and integrity of U.S. carriers, manufacturers and safety authorities; it is a very different matter from the imposition of operational restrictions on the grounds of unreasonable jet noise.

Probably the Italian position will be argued as follows: "It is accepted practice to divert aircraft from airports in difficult traffic-control situations. Our decision is merely an extension of such a situation." However, it is just possible that the Italian decision is not unconnected with Alitalia's wish for a jet surcharge, which PanAm (though not T.W.A.) are against.

The surprise announcement was made by Sr. Guiseppe Caron, Italian Under-Secretary for Civil Aviation, on September 18. Sr. Caron said: "The reason . . . is that Ciampino is already overcrowded, and regular flights by such an aircraft as the Boeing 707 would put an undue strain on safety regulations [and] would present a problem which it might be possible to solve on a technical level, but which might lower the safety level."

Meanwhile, last Friday, Mr. A. Jackson Kelly, Pan American's European vice-president, flew from London to Rome for talks with the Italian Government. It is understood that the Italians do not include the Comet 4 in their "ban."

THE SAFARI CONTROVERSY

WHEN B.O.A.C. complained, in their 1957-58 annual report, about the effect upon the Corporation of African Safari-service competition by the independents, *Flight* commented on aspects of this competition which the Corporation appeared to have overlooked (August 8, page 209 and August 15, page 245). Briefly B.O.A.C. had said that independent Viscounts had diverted their traffic. In fact the Corporation could have operated its Britannias, and in any case traffic diversion is likely to have been slight.

However, when Hunting-Clan issued their strongly worded "reply" to B.O.A.C., we suggested—with no prompting—that this reply was provocative, and that some of its points were open to criticism. (See *Flight*, September 12, page 472, and September 19, page 497.)

This drew a mild protest from Hunting, and it is only fair to record its viewpoint, which is as follows: (1) The fact that B.O.A.C. chartered three Viscounts for M.E.A. has, say Hunting-Clan, nothing to do with the African-route question. (2) It is not possible to give "evidence" that H.C.A.'s Viscounts were banned from the African routes, but Hunting-Clan had extremely good reasons to believe that there was no point in pressing to put Viscounts on the Safari route. (3) Hunting-Clan did not suggest that material diversion could be *disproved*, maintaining that their long waiting lists were ample evidence that there had been no diversion. (4) On the question that B.O.A.C. were attempting to set up a monopoly, Hunting-Clan put on record that an approach to B.O.A.C. to discuss the implications of the Minister's "30 per cent independents, 70 per cent B.O.A.C." decision was rejected out of hand by B.O.A.C.. (5) Hunting-Clan reiterate their contention that B.O.A.C.'s complaint suggests incompetency on the part of the A.T.A.C.

It is tempting further to discuss these points; but to do so would be sterile. The grounds for our comments on Hunting's "reply"—comments by which we abide—were mainly a reaction to the manner of its presentation which, however, was understandable.

The real issue does not turn upon partisan independent or Corporation complaints, and their rights and wrongs, but upon the fact that—we quote from *Flight*, December 6, 1957, page 867—"there seems to be a growing strain upon the machinery responsible for the smooth co-ordination of British air transport."

KEEPING UP WITH THE CONVAIRS

WHEN Convair revealed last month the faster, heavier 600 version of the Convair 880, it seemed likely that Boeing might respond with an improved model of the 720 (707-120). The two medium jets have always been closely competitive: indeed, the 720—lightest member of the 707 family—was the direct result of Convair 880 (and perhaps also Comet) influence.

Now Boeing announce performance improvements to the 720 to give the aircraft "the highest point-to-point speeds of any transport in its class." A major change is the addition of more wing leading-edge to increase sweep-back and to reduce t/c ratio. Cruising speed goes up to 614 m.p.h. at the low height of 22,700ft, which is presumably the altitude for maximum speed (i.e., where the line for limiting Mach number—now up to 0.9—intersects the line for limiting I.A.S.).

Boeing do not refer to any improvements in operating cost, but put on record the fact that these new 720 improvements are the result of "a continuing programme of development on the part of Boeing aerodynamicists, structural and performance experts." Here, perfectly illustrated, is the motivation behind the campaign for a fare-differential—the main purpose of which is to avoid exclusive preoccupation with the "I can go faster than you" approach to air transport.

MORE ROOM AT THE INN

SIR ARTHUR MORSE, the chairman of the British Travel and Holidays Association, has put his finger firmly on the reason behind the alleged shortage of tourist facilities that is so troubling the world's airlines. The latest annual report of the B.T.H.A. warns the travel trade that "there is a danger of distortion in industry, due to investment in transport having far outstripped investment in provision of services at the destination."

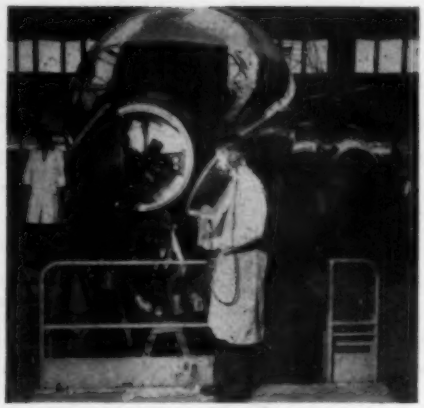
Sir Arthur does not elaborate on the factors that have led to this distortion, but the certain answer is that transport generally—particularly air transport—is subsidized. Because airlines have not had to recover from their traffic all the costs of providing air services, passengers have over the years been given a discount on air travel. But in only a few countries have hotel guests been given this same concession. If there is to be an equilibrium between the numbers of airliner seats and of hotel bedrooms, Governments must either clamp down on direct and indirect financial support given to civil aviation or give greater concessions to those wishing to invest in hotel accommodation.

The B.T.H.A. report provides strong evidence for helping hoteliers rather than restraining airlines. For the third successive year, more than one million visitors came to Britain in 1957. They are estimated to have spent £181m (including £52m to British carriers) of which one-third was in dollars. This means that Britain now earns more from tourism than any other European country and receives more dollars from American tourists than from any single British product exported to the U.S.

NEW DCs FOR OLD

ACCORDING to an application filed with the C.A.B., Douglas made an agreement a year ago with United Air Lines to buy back ten DC-7s for about $10m to help United finance the purchase of six DC-8s. The DC-7s were to be returned to Douglas one per month from November 1959 to August 1960. C.A.B. approval was required under Section 408 of the Civil Aeronautics Act dealing with "consolidation, merger and acquisition of control." The price of the DC-7s was fixed at $1.25m each, to be reduced by $5,000 for each month in service.

It is known that a similar arrangement exists between Douglas and Northwest (*Flight*, May 9, 1958), but it was believed at the time that this was the first occasion on which Douglas had entered into such an arrangement with a customer. In fact, Douglas appear to have been in the buy-back business for at least as long as Lockheed. The academic question is: Who started it?



Left, a proud moment for the 1m-sq ft Chester production factory of de Havilland Aircraft was the recent rolling out of its first Comet 4. The aircraft is G-APDE, the fifth of B.O.A.C.'s fleet of 19 Comet 4s. It first flew last Saturday, and went to Hatfield for its tests. Right, a new product of D.H. Propellers, Ltd.—seen here in use on the Hatfield Comet 4 line—is a 19 lb portable cable-tester. It is a convenient means of checking the continuity and insulation of multi-core electrical cables, a process which usually requires bulky equipment.

CIVIL AVIATION . . .

I.A.T.A. AND THE C.A.B.

THE American Civil Aeronautics Board and the International Air Transport Association have never been the best of friends. Few I.A.T.A. airlines conceal their resentment of the C.A.B.'s influence over their rate-making deliberations, an influence which is manifest most strongly in the C.A.B.'s statement of policy always issued to the U.S. airlines before they sit down with other I.A.T.A. members to talk fares.

Obviously there is little point in I.A.T.A.'s making decisions which would be against C.A.B. principles; but at least it can be said that these principles are made known by the C.A.B. before, and not after, I.A.T.A. traffic conferences. In this way any C.A.B. disapproval of I.A.T.A. agreements is on the basis of "you were warned."

These C.A.B. policy statements are always of particular interest, because they provide a forecast of the kind of atmosphere to be expected at I.A.T.A. traffic conferences. The Cannes meeting, which opened last Tuesday, September 23, and which may continue beyond mid-October, promises to be the most crucial ever. Therefore the paper recently issued by the C.A.B. to American members of I.A.T.A. (entitled "Statement with respect to the major issues to be considered at the I.A.T.A. traffic conference meetings, Cannes, September 23, 1958") is unusually significant. These are the main parts made in the statement:

Type of Service. "The Board considers it essential that jet services be integrated into the fare structure in such a manner as will permit their operation in any class of service . . . A critical factor determining the cost of operating jets will be the seating configuration used, and we expect the carriers to make full use of the carrying capacity of these aircraft."

North Atlantic Fares. "Recognizing the responsiveness of tourist travel to changes in prices, the Board believes that the currently effective general level of fares should not be increased . . . It is particularly necessary to the stimulation of traffic development that the economy-class be retained substantially as now constituted, and that the level of fares for this service, which is significantly higher than that originally agreed to, be retained or reduced."

Trans-Pacific Fares. "Jets will probably not be placed in service during the year in question and, as a result, the problem of developing traffic is not as urgent as in the case of the North Atlantic . . . In the absence of desirable reasons to the contrary, the currently effective level of trans-Pacific fares should not be increased."

U.S. - Latin America Fares. "The Board is aware of the present competitive situation in the Caribbean and South American areas. The carriers concerned have not as yet presented any concrete proposals designed to meet this situation. In the absence of any such proposals, the Board is not in a position to comment on this matter."

North Atlantic Cargo Rates. Two steps should be taken by I.A.T.A. to meet "the critical problems presented by the imminent sharp increase in cargo capacity accompanying introduction of jets." These are, first, "weight break-points should be introduced within the present specific commodity rate structure," and, second, "the carriers should introduce a mixed consignment rule."

A further statement by the C.A.B. did not seem likely to ease the strain of the I.A.T.A. - C.A.B. relationship: "The Board expects airlines to include in their minutes summaries of all deliberations, formal and informal, whether or not they result in agreed resolutions." These were needed, the C.A.B. said, "to understand the background of, and to review promptly and effectively the actions taken by I.A.T.A. members."

—C.A.B. AND THE DIFFERENTIAL

THE Board's policy statement (col. 1) has been widely interpreted as an expression of opposition to fare differentials and to fare increases. In fact, a close study of the actual words used in the statement reveals that such interpretations are far from being accurate.

Rather than expressing opposition to differentials, the statement went no further than to emphasize that jets must neither be restricted to first-class services nor *banned from carrying economy-class traffic*. This does not rule out the possibility that any particular class of passenger might be able to pay slightly less and travel on slower aircraft.

It would also be misleading to believe that the Board would obstruct any fare increases. Professor Cherington's suggested policy of increasing first-class fares and simultaneously reducing the lowest fares is likely to be accepted by the C.A.B. as the basis for determining internal U.S. fares. And nothing in the Board's recent statement implies any opposition to adopting a similar basis in the international sphere.

PANAM-NATIONAL AGREEMENT

THE possibility that National Airlines may become the first American domestic carrier to introduce jet transports is the implication of an agreement signed between National and Pan American.

According to *Aviation Week*, the Civil Aeronautics Board has been approached by the two carriers with the following proposals: (1) Pan American will have the option of buying 250,000 National shares over a three-year period; (2) Each airline will issue to the other 400,000 shares: (3) PanAm, under a short-term lease arrangement, will lease Boeing 707-120s to National for the next two winter seasons, the first operation to begin on December 10, 1958; (4) under a long-term lease arrangement, National will lease two DC-8s to PanAm for summer peak requirements and PanAm in turn will lease two 707-120s, 707-320s or DC-8s to meet National's winter requirements. This long-term lease would begin on May 15, 1960, and would last for ten years.

The immediate implication of the short-term lease arrangement is that National, who do not take delivery of their six DC-8s until 1960, will have a considerable competitive advantage over Eastern and Northeast on the lucrative New York - Miami route. Eastern propose to introduce Electras just before the Christmas holiday traffic-peak, and Northeast will no doubt introduce their newly acquired Viscount 745s on to this route. (Northeast's decision to buy Viscounts after cancelling their Britannia order must have been considerably influenced by the need for competitive equipment on the Miami route—a need which originally inspired the order for Britannias to be introduced into service for the December 1957 season.)

National intend to operate 707 services to Florida, starting on December 10, as a daily operation until December 15, increasing frequency to twice-daily from that date until April 26. The aircraft will retain PanAm markings and all maintenance and training will be handled by Pan American.

ELECTRA TURBOPROPS 1,000 HR LIFE

WHEN the Rolls-Royce Avon RA.29 of the Comet 4 was approved for 1,000 hr (*Flight*, July, 25) there was justified acclamation for an unprecedented achievement. Never before had a transport engine, still less a turbine engine, been approved for a four-figure overhaul life before the start of services.

It is therefore with similar acclamation that the award by the

C.A.A. of a 1,000 hr overhaul life to the Allison 501—turboprop engine of the Lockheed Electra—must be recorded.

Allison's achievement is particularly notable in that their engine will enter service with an overhaul life greater than that possessed by any other turboprop upon entry into service. The Rolls-Royce Dart 506 began operations in 1953 with a life of 600 hr (which is now up to 2,000) and the Bristol Proteus 705 began operations in 1957 with a life of 500 hr (now 1,800 hr).

No doubt the biggest single factor in the Allison 501 achievement is the enormous background of operational service acquired by the T56 military version of the engine fitted to 150 C-130s which have been in operation with the U.S.A.F. for two years. This engine is cleared by the U.S.A.F. for 1,200 hr.

The first Electras to enter service will be those soon to be delivered to Eastern Air Lines, which will begin Electra operations on December 1. As previously recorded, certification of the Electra was granted on August 26.

COMMONWEALTH CO-OPERATION

BY sensible arrangement, the Colonial Office and the Ministry of Transport and Civil Aviation convened a conference on Colonial Air Transport to coincide with the Farnborough Show. The conference opened on September 5 and continued until September 10, and was attended by Directors of Civil Aviation in the colonies and by representatives from the U.K.

The object of the conference was to explore informally the problems facing colonial air transport authorities. Discussion covered such subjects as the need for improved statistical coverage, but emphasis was inevitably placed on the problems arising out of jet operation. It was generally recognized that the jet-age had dawned rather more suddenly than had been thought likely at the last Colonial Conference in 1952, and there was an admission that authorities would not be wholly prepared in many cases. In certain instances a note of resentment could be felt: not only had the airlines frequently failed to consult those responsible for airports and airways, but there still remained considerable doubt as to the airlines' precise operational intentions.

The cost of providing longer and stronger runways, improved navigational aids and more appropriate handling facilities was also discussed, together with the means whereby this could be financed. A particularly thorny problem appeared to be the possibility of paying for facilities that might prove unwanted in but a few years' time.

The Colonial Office conference was not the only gathering convened at Farnborough-time to discuss air-transport matters. The Ministry of Supply also took the opportunity of discussing with Commonwealth airlines their equipment requirements. This was the third M.o.S. conference of its kind to be held, the previous two having taken place in 1956 and 1957 (also in September). British aircraft manufacturers were not represented at the latest meeting, it being felt that their absence would permit a more frank airing and comparing of views. The idea of holding these meetings arose from a resolution passed at the 1952 Colonial Office conference.

GHANA'S NATIONAL CARRIER

WITHIN the coming week all air services within Ghana will be taken over by a new State airline, Ghana Airways, Ltd. Since mid-July some services between London and Accra have been operated by B.O.A.C. Stratocruisers in Ghana Airways' livery. But from October 1 the airline will start internal and regional services with their own aircraft, crews and management.

There has been some confusion concerning Ghana Airways procurement programme. It has been thought, at different times, that they were to acquire used DC-3s from Aden Airways and Herons from West African Airways. Neither rumour is true. A single DC-3 is to be acquired from Field Aircraft Services and two new Herons are to be bought from de Havilland. The DC-3 has an interesting background history: this aircraft was one of the last of its type having been built in 1944 for the U.S.A.F. After having accumulated only about 4,000 hr it suffered a slight taxying accident in Iceland in 1956 and was sold to Icelandic Airways. This carrier did not actually operate the aircraft and early the following year transferred it to Field Aircraft Services. Since then Field's have completely rebuilt the aircraft as a 28-seater, incorporating such features as the Transair undercarriage, disc brakes and new instrumentation throughout. It is, indeed, the nearest possible approach to a new DC-3, tailor-built to the precise requirements of Ghana Airways. The Board of Directors had at one time considered obtaining one of Aden Airways DC-3s but in view of local conditions the rebuilt aircraft seemed clearly to be the better investment. Unusually high humidity prevailing in West Africa dictates that aircraft be entirely free from corrosion and suited both internally and externally to trouble-free tropical operation. In addition, a major obstacle to development of air transport in this region—fear of flying—makes it imperative to avoid even the suggestion that the company's aircraft are in any way inferior.

The DC-3 will be named after the country's premier, Dr. Kwame Nkrumah, and will operate regional services eastwards from Accra to Lagos, and westwards through Liberia, Sierra Leone and the Gambia to Dakar.

The same factors which led to the purchase of Field's rebuilt DC-3 were instrumental in buying new rather than used Herons. These two aircraft will be placed on Ghana's internal services, taking over from those at present flown by West African Airways. Initially these operations will remain unchanged, the only points served being Accra, Takoradi, Kumasi and Tamale. But the Department of Civil Aviation is already investigating the situation regarding a number of wartime airfields that have now gone out of use, and will be advising on the cost of restoring these to a condition suitable for Heron operations. Ghana Airways will then be able to evaluate the possibilities of expanding internal scheduled services. As the two aircraft ordered from de Havilland will not be delivered until the end of this year, the airline will charter Herons from West African Airways until December.

It is almost certain that Ghana Airways will also acquire a Twin Pioneer for operating into less accessible points. The main purpose of this will be to provide the Government with a vehicle capable of placing any part of the country within a few hours' travel-time from Accra, but its presence will allow the initiation of regular services to points never previously served by air.

The desert services to Europe will continue to be operated jointly by Ghana Airways and by B.O.A.C. (the Corporation has a 40 per cent share in Ghana's airline). The present charter arrangement will continue, although the Stratocruisers will probably be replaced by Britannias next year. The airline is particularly interested in the possibilities of extending the desert network to reach more territories in North Africa and the Middle East. As regards the coastal routes to Europe, the Government feels well disposed to Airwork and Hunting-Clan (joint operators of the Safari service), but as traffic on this route increases the airline will consider the operation of their own Viscount service in parallel with those of the Safari Viscounts.

Another planned development is to enter the pilgrim market. Every summer thousands of Moslems make the difficult journey from West Africa to Mecca, usually travelling overland but in some cases flying from points in French West Africa and Nigeria. Ghana Airways have already circulated a questionnaire locally and have also invited comments on the radio and in the Press, and from the replies hope to build up a picture of the nature and extent of this market.

A staff nucleus exists in the form of 60-odd Ghanaians already in the employment of W.A.A.C. The total establishment will stand initially at about 100 employees and this will be expanded as the airline develops. The majority of senior executives will at first be seconded from B.O.A.C., but the management contract makes allowance for a continuous programme of "Africanization." Recognizing that this will involve the airline in additional training costs, the Government has agreed to contribute towards this.

Although prestige plays a major part in the Ghana Government's attitude to the airline, the directors are determined to run it on commercial lines and at a profit. Any uneconomic activities which the airline might be requested to perform will be the subject of hard bargaining between Government and management.

Air-India's vice-chairman and general manager, Mr. B. R. Patel, is seen here at the party recently held in his honour at the airline's new London booking-office. Mr. Patel was in England to visit the S.B.A.C. Display and to inspect his airline's new London office facilities.

Butler Air Transport's three ex-B.E.A. Ambassadors have now been returned to this country, and their re-sale will be arranged by the original owners. Their disposal by Butler was recorded in "Flight" of August 22, page 255.

CIVIL AVIATION . . .

PROOF OF THE PUDDING

BRISTOL'S sales engineering department has issued a comprehensive account of the Britannia in airline service. Since the first London - Johannesburg service on February 1, 1957, Britannias have accumulated over 80,000 flying hours, and are now in operation with B.O.A.C., El Al, Aeronaves de Mexico and Canadian Pacific. Operators awaiting delivery are Hunting-Clan, Cubana, Air Charter and R.A.F. Transport Command. Three on order for the Ministry of Supply will probably be operated by a British independent airline on a long-term trooping contract. The order book covers 75 aircraft of which 41 have been delivered (100 series, 15; 300/310 series, 26). Still to be delivered are eleven 300/310s and 23 military 250s.

From a passenger viewpoint, the appeal of these aircraft is shown by El Al's traffic across the North Atlantic which, in the first half of this year, was 157 per cent higher than in 1957. (Equally impressive, although not mentioned in the Bristol report, is B.O.A.C.'s North Atlantic experience: over the last six months their Britannia load-factors have averaged 78 per cent westbound and 82 per cent eastbound.)

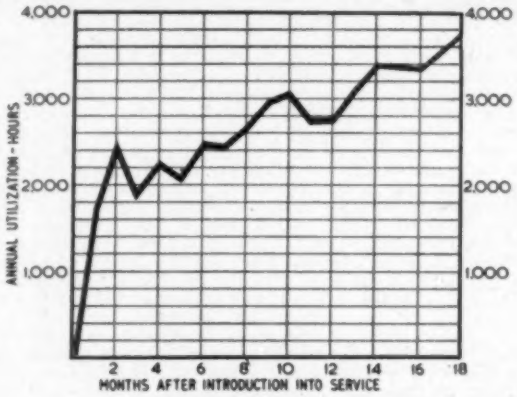
B.O.A.C.'s fleet of 15 Britannia 102s have been put into operation on the routes through India, South-East Asia and Central Africa that are generally accepted as being "among the most difficult to operate in the world." This fleet has produced 420m seat-miles (average load-factor over 70 per cent), having achieved a daily utilization rate of eight hours after one year in service, and now averaging over ten hours daily per aircraft. The 312s started flying to North America on December 19, 1957, and have since July 27 also been operating to southern Africa.

El Al started a Britannia service once weekly between Tel Aviv and New York on December 22, 1957, and has now built up the frequency to five flights a week. With three 313s this is equivalent to a daily utilization rate exceeding eight hours. Another aircraft has been loaned to the Israeli airline (pending delivery of a fourth 313), this being used to provide extra capacity between London and Tel Aviv.

Aeronaves de Mexico operate a daily non-stop return flight between Mexico City and New York (one way distance 2,093 miles) with two 302s, and have recently declared the Proteus engine to be "the nearest approach to the ideal propulsion unit for transport aircraft."

Canadian Pacific Airlines inaugurated Britannia services on their Vancouver - Amsterdam polar route on June 1. Average round trip ramp-to-ramp times for the 314s have subsequently averaged about 30 hr as against 39 hr for their DC-6Bs. On August 24 Britannias were also placed on the Tokyo route.

Discussing the engineering aspects of Britannia operations, the report describes B.O.A.C.'s fleet results in detail. After twelve months in service, delays due to unscheduled maintenance had taken place on 17 per cent of all flights. Non-availability of spares led to a few delays of over six hours' duration, but if these cases are excluded the average delay was only nine minutes, a figure



Increase in Britannia 102 utilization—now 3,760 hr.

that "compares favourably with any other large commercial airliner in service today." Flying hours between checks have been continually increased, and since last July have stood at 125, 315, 1,100 and 2,500 hr for Checks 1, 2, 3 and 4 respectively. An analysis of component-removals shows that of 24 components showing a removal rate of over once every 1,000 hr, 16 were electrics, five were propulsion, two were hydraulics and one was miscellaneous. The Proteus 705 overhaul life reached 1,600 hr after 210,000 flying hours, an achievement which is said to be "considerably better than any other known engine, piston or turboprop." Trials are now taking place at 1,900 hr.

BREVITIES

THE chairman of B.W.I.A., Sir Errol dos Santos, and the airline's general manager, Mr. John Rahr, were in London last week to discuss the airline's future. Recent reports—not confirmed by B.O.A.C.—suggested that the Corporation is no longer prepared to underwrite B.W.I.A. deficits.

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Price of the complete Fairchild F-27 is now quoted as $590,000 for the RDa.6 version and $660,000 for the RDa.7. According to *Aviation Week* 300 F-27s must be sold to break even.

* * *

Mr. Howard Hughes' order for a Viscount 763 has been cancelled. The aircraft has been in storage awaiting collection at Weybridge for two years.

* * *

An Overseas National Airways DC-4 on charter to the U.S.A.F. was last week forced by two French fighter aircraft to land at Biskra, Algeria. After inspection the DC-4 was allowed to continue.

* * *

Rolls-Royce confirm that the cause of the failure which resulted in the loss of the Dart Herald has been established. As a precaution, B.E.A. have been inspecting their Dart 520s (Viscount 806). It is understood that only a small batch was suspect.

* * *

Iraqi Airways plan to reduce their British staff, at present standing at about nine aircrew and 36 maintenance staff, to some four aircrew and 20 engineers. Last week the Iraqis announced that normal international air services to their country—discontinued in the July coup—could now be resumed.

The United Arab Republic has agreed to the extension of Aeroflot's Tu-104 Albanian services from Tirana to Cairo.

* * *

The new president of T.W.A., Mr. Charles S. Thomas, said in London last Saturday that T.W.A. favoured a fare-differential with higher fares for jets.

* * *

Monthly traffic claimed by American Airlines in August was the first since last January to show an increase over the figure for the corresponding month of 1957.

* * *

Central African Airways have introduced concessionary fares for five-day excursions from centres in the Federation to the Victoria Falls at Livingstone.

* * *

T.A.I.'s operations from Paris to the South Pacific are to be extended from New Caledonia (Noumea) to the Society Islands (Bora Bora and Tahiti).

* * *

An interesting new registration appears in the September issue of the *Register of British Civil Aircraft*. It is G-APOH, allocated to the Hunting H.107 twin-jet airliner project.

* * *

As *Flight* went to press de Havilland Comet 4 G-APDA, was half-way through its second world proving flight, having arrived at Buenos Aires via Mexico City (see programme in last week's issue, p. 502). The aircraft is due to return to Hatfield from New York tomorrow, September 27, having qualified for its certificate of airworthiness.

SERVICE AVIATION

Battle of Britain Week

THIS year's Battle of Britain Week, from September 15 to last Sunday, was marked by the traditional R.A.F. ceremonies and "at homes" and marred by one sad accident—when the Conway-Vulcan was destroyed at Syerston with the loss of seven lives (see p. 508).

On Monday, September 15, Lord Dowding, A.O.C-in-C. Fighter Command in 1940, laid a wreath on the Air Forces Memorial on the Victoria Embankment in London on behalf of the Battle of Britain Fighter Association; and last Sunday a fly-past of nine Javelins, preceded by a Hurricane and a Spitfire, followed the annual Thanksgiving Service—this year held for the first time at St. Paul's Cathedral as Westminster Abbey is at present partially closed for cleaning.

Thirty-four R.A.F. stations were "at home" to the public last Saturday and over 1,147,000 people visited them—a total which the Air Ministry said was 75,000 more than last year, when 38 stations were open. The reports which follow describe flying displays at Biggin Hill and Gaydon; those at Valley and Turnhouse will be briefly described next week.

For one long, action-packed afternoon **Biggin Hill** emerged from its second-line limbo. The R.A.F., U.S.A.F., aircraft industry and flying clubs weighed in to stage a bumper display for some 260,000 spectators.

The giants were there—No. 111 Sqn., the Skyblazers (scarred and dazzled, with cracking afterburners and snazzy paint schemes), the three V-bombers sailing past in impeccable vic formation; and a single Vulcan which expunged any memories of vapid V-bomber displays with some real close-quarters work and one howling full-bore pass.

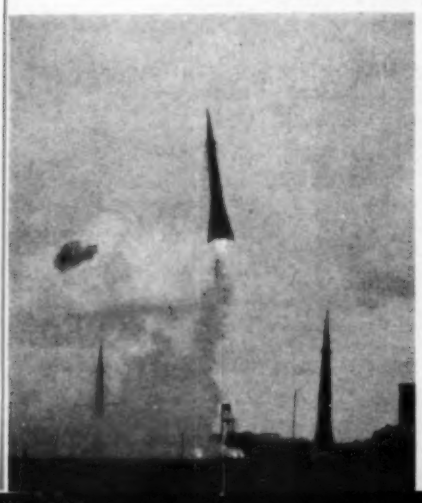
Touring formations flying past were enlivened by the Tactical Air Command "suckling pig" multiple hook-up of two F-100s and one B-66 to a KB-50J tanker which had "four turning and two burning." Industry chipped in handsomely with the Westland Wessex - Whirlwind - Widgeon troupe, Fairey Rotodyne and F.D.2, Folland Gnat, Hawker Tomtit, Jeffrey Quill's Spitfire, Scottish Aviation Twin Pioneer CC.1 and Gloster Gladiator. The Tiger Club staged an exhilarating "dirt track" handicap race and two Turbulents turbulated bravely. London U.A.S. put up a fine Chipmunk display, flying three tied together—the first Service effort of this kind for very many years—and three more in a skilful formation aerobatic display.

The traditional set-piece involved the "liberation" of an "egg-head" scientist and his desirable black box from a native missile site. Half a dozen helicopters and an Auster A.O.P.9 supported a really smoky, noisy attack and the missiles fizzled and walloped into the air just after the egghead had been borne off dangling under a Sycamore. A Hastings in target - towing markings dropped 200 sugared mice on tiny parachutes over the crowd. Expert individual aerobatics were performed by a Meteor, Vampire, Provost and the Bishop Tiger.

At **Gaydon,** which lies between Warwick and Banbury, some 70,000 people from the Midland towns came to see a programme which centred upon the station's Victors and Valiants but was comprehensive enough to provide a good visual cross-section of R.A.F. activity. Thus in the static show the O.C.U.'s resident V-bombers flanked a Vulcan from Waddington; Fighter Command was represented by a Hunter and Javelin; Coastal by a Shackleton and Flying Training by a Vampire and Provost. Other types available for close inspection by the public were a Canberra and a U.S.A.F. F-100F, and (to give the setting an historical perspective) a Spitfire and a Lincoln. All these types, apart from the Lincoln and Spitfire, were represented in the flying display—which also contained several non-R.A.F. participants. Among these, two of the most interesting were an 800-series Viscount in Capital Airlines livery which flew past with its two port engines feathered and a Gannet flown by Mr. H. W. Rayner of Armstrong Siddeley, who twice feathered both his Mambas, once when inverted. The Army Air Corps also participated, an Auster 9 from Middle Wallop showing how to fly confidently below tree-top level; so did the Navy, Lt-Cdr. Philips demonstrating his veteran skill in a Whirlwind.

Chiefly, however, the afternoon's show (quite rightly) was an R.A.F. one and almost every type of aircraft now in service put in an appearance, from Hunters, Swifts (with Fireflash) and Javelins to a Hastings and three Varsities. The most spectacular item was by the Hunter F.5s of No. 56 Sqn., who showed themselves as muscularly equipped with aerobatic prowess as their Avon-powered rivals in Treble-One. Four Canberras from Bassingbourn had the misfortune to perform when a heavy shower had driven most spectators to seek shelter, Harry Pollitt—another civilian participant—being luckier when he subsequently found clear skies for his splendid Javelin demonstration. It was fitting, however, that the start and end of the display should have been by the V-bombers, not performing any Farnborough "circus tricks," but showing clearly how confidently Bomber Command handles its splendid new aeroplanes. This was something of a swan-song for the chief instructor, W/C. D. Iveson (flying a Victor), for he is shortly leaving to take over command at Waddington and add Vulcans to his V-bomber experience.

Nine Javelins of No. 46 Sqn. (top of page) flew over St. Paul's Cathedral last Sunday after the Battle of Britain thanksgiving service there. In the centre picture below the Lord Mayor of London, Sir Denis Truscott, takes the salute during the fly-past, in which the Javelins were preceded by a lone Spitfire and Hurricane. Below, left, a "missile" is launched during the Biggin Hill "at home"; and on the right, a Battle of Britain Spitfire in contrast with a Thunderbird at the R.A.F. exhibition on Horse Guards Parade.



SERVICE AVIATION . . .

Royal Visitor

PRINCE PHILIP is to visit R.A.F. stations North Coates, Grimsby, and Patrington, Hull, on November 19.

Vulcan's Fast Crossing

A VULCAN of R.A.F. Bomber Command, with W/C. F. L. Dodd as captain and the C-in-C., Air Chief Marshal Sir Harry Broadhurst, as co-pilot flew from Goose Bay in Labrador to R.A.F. Waddington in 4 hr 11 min on September 18. Its coast-to-coast flight, from Goose Bay to Northern Ireland, was made in 3 hr 27 min at an average speed of 648 m.p.h.

S.A.C. Competition

AN invitation to take part in this year's U.S.A.F. Strategic Air Command bombing and navigation competitions—to be held in California during October—has been accepted by the R.A.F. Two teams will be entered by Bomber Command, each consisting of four Valiants and crews.

Senior Signals Post

FORMERLY Chief of the Electronics Branch in the Signals Division at SHAPE, G/C. A. G. Powell recently took over the post of S.A.S.O. at No. 90 (Signals) Group with the acting rank of air commodore.

Prior to his SHAPE appointment, A. Cdre. Powell had been Deputy Director of Signals (Plans) from June 1952 to June 1955 and before that was for two years Deputy Chief Signals Officer at H.Q., M.E.A.F. During the war he was twice mentioned in despatches.

Sea Venom Saved

AFTER a flame-out had occurred in the Sea Venom he was flying inverted at 10,000ft over R.N.A.S. Abbotsinch on September 16 a Naval pilot, Lt. J. Gilbert, made a successful forced landing on the airfield. Visibility was very poor at the time, and the pilot's commanding officer, Capt. E. N. Poland, described the successful landing—during which Lt. Gilbert kept in radio touch with control—as "a superb piece of airmanship."

A.A. Frigate

WITH the primary rôle of air defence of a surface force but able to be employed in an A.S. or air direction rôle and for defence against surface attack, H.M.S. *Leopard*—nameship of the latest class of R.N. anti-aircraft frigates—is to be commissioned at Portsmouth next Tuesday, September 30. She is equipped with four power-operated 4.5in guns in twin turrets and twin 40 mm guns.

R.A.A.F. Overseas Move

WHAT is described as "one of the most important peace-time movements of aircraft in the history of the R.A.A.F." is planned to start during November when Avon-Sabres of No. 78 Fighter Wing begin their move from Williamtown, N.S.W., to Butterworth in Malaya. The aircraft belong to Nos. 3 and 77 Sqns. and are going to their new base as part of the R.A.A.F. commitment to the Strategic Reserve in Malaya.

This move is to be made in two divisions, about 20 Sabres of No. 3 Sqn. flying to Butterworth in November and the aircraft of No. 77 Sqn. following early next year. The 6,000-mile route (through New Guinea, the Philippines and Borneo) has been surveyed by R.A.A.F. Dakotas and the Sabres will fly in groups of four, aided by Canberras to provide navigational assistance and to secure weather forecasts. Neptunes of No. 11 (M.R.) Sqn., based at Richmond in N.S.W., will provide A.S.R. facilities along the eastern half of the route.

Rear Admiral C. L. G. Evans, Deputy Chief of Naval Personnel, presents Midshipman C. L. James with his brevet at the passing-out parade of No. 33 Observer Course at R.N.A.S. Culdrose. On the right is the captain of the station, Capt. H. S. Barber.

Air Experience Flights

FIFTY R.A.F. Chipmunks will by the end of this month be delivered to 13 R.A.F. and civil airfields to provide cadets in the A.T.C. and the air sections of the C.C.F. with passenger flying experience. The aircraft will be operated by Air Experience Flights, each commanded by a flight lieutenant, and based at Biggin Hill, Cambridge, Cosford, Exeter, Filton, Newton, Ouston, Southampton, Sydenham, White Waltham, Woodvale, Turnhouse and Yeadon. Some 200 pilots have been specially commissioned during the last few weeks into the training branch of the R.A.F.V.R. to fly the Chipmunks; they are all former members of the R.A.F. and R.Aux.A.F. and include commercial pilots (with B.O.A.C., B.E.A. and some of the independent airlines) and civil flying instructors.

R.A.F. Appointments

AMONG appointments recently announced by Air Ministry are the following:—

G/Cs B. S. Cartmel to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; K. H. Gooding to H.Q., Bomber Command, for administrative staff duties; P. P. Hanks to R.A.F. Patrington, to command; H. P. R. Smith to be President, Central Medical Board and Adviser in Aviation Physiology, Central Medical Establishment, London; D. W. I. Thomas to R.A.F. Hospital, Wegberg, to command.

W/Cs R. Bradshaw to H.Q., Bomber Command, for administrative staff duties; J. M. Ferguson to R.A.F. Bahrein, as Senior Medical Officer; R. O. M. Jones to H.Q., Home Command, for medical staff duties; W. R. J. Marriott to H.Q., No. 23 Group, for technical staff duties; P. G. H. Matthews to R.A.F. Waddington, for administrative duties; R. Seidelin to R.A.F. Hospital, Nocton Hall, to be in charge of the medical division; D. F. S. Shaw to R.A.F. Halton, as Senior Medical Officer; A. G. Sollis to R.A.F. Waterbeach, for technical duties; J. J. Barr to the Army Staff College, Camberley, for directing staff duties; A. H. Hewitt to R.A.F. Wildenrath, 2nd T.A.F., for technical duties; D. I. Pike to H.Q., Allied Air Forces Northern Europe, for staff duties; V. Rees to R.A.F. Biggin Hill, to command London U.A.S.; K. Ritchley to R.A.F. Gaydon to command the Flying Wing; E. W. D. Boy to H.Q., 2nd A.T.A.F., as officer commanding the International Support Unit; P. G. Tyler to U.S.A.F. Air Materiel Command for exchange duties; E. J. Watts to No. 16 M.U., for technical duties.

S/L. J. W. Hume to H.Q., Bomber Command, for technical staff duties (with acting rank of wing commander).

Aberdeen U.A.S. Dinner

THIS year's annual dinner of Aberdeen University Air Squadron will be held on Saturday, November 8, in the Caledonian Hotel, Aberdeen. All past and present officers and members who are interested in attending are asked to write to the Secretary, Aberdeen U.A.S., R.A.F., Bedford Road, Aberdeen, as soon as possible.

IN BRIEF

R.A.F. St. Mawgan won the 1958 R.A.F. Unit Farms and Gardens Competition by two points from R.A.F. Stafford. Third in the competition was R.A.F. Cranwell.

* * * * *

The R.A.F. Benevolent Fund spent £266,107 on the relief of distress among past and present members of the R.A.F., W.R.A.F. and their families and dependents during the first six months of this year. A total of £278,162 was expended on all forms of assistance.

* * * * *

W/C. A. G. Parnall made a gift of 375 acres of cliff and foreshore in Cornwall to the National Trust on September 15, Battle of Britain Day, in memory of his brother, F/L. D. Parnall, and aircrew who died in the Battle of Britain. F/L. Parnall was killed on September 18, 1940, while flying a Hurricane of No. 249 Sqn. from North Weald.

A T-33 of the R.C.A.F. flies over the Eisenhower Dam, on the U.S. side of the new St. Lawrence Seaway, during practice for the recent International Air Show at Toronto.

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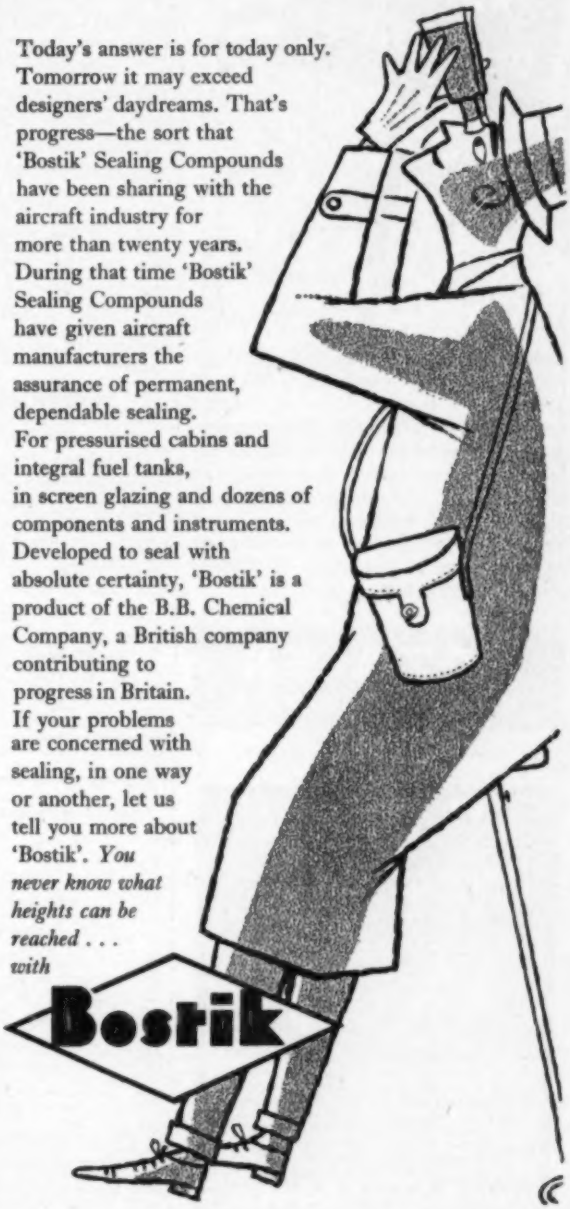

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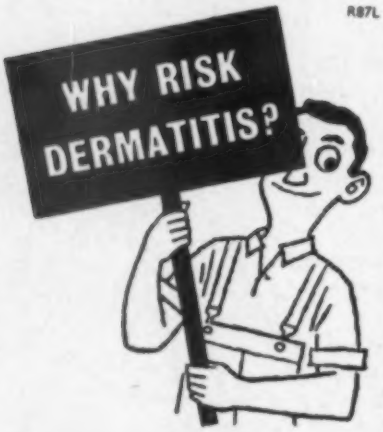

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AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services:

FROM Eagle Airways, Ltd., of 40 Edgware Road, London, W.2: Application No. 1429/1 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorised to operate on the route Manchester (Ringway) - Lyons (opt. tech.) - Pisa so as to permit them to operate on the route Manchester - Frankfurt - Pisa.

FROM Hunting-Clan Air Transport, Ltd., of London Airport, Hounslow, Middx.: Application No. 321/4 for an extension of the period of approval of the Colonial Coach Class Service which they are authorised to operate on the route London - Biarritz (tech.) - Gibraltar until December 23, 1958, so as to permit the service to operate until December 23, 1965.

FROM the British Overseas Airways Corporation of London Airport, Hounslow, Middx.: Application No. 460/4 for permission to include an additional optional traffic stop at Zurich on their All Freight Service between London and Singapore approved under Application No. 460.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [8351

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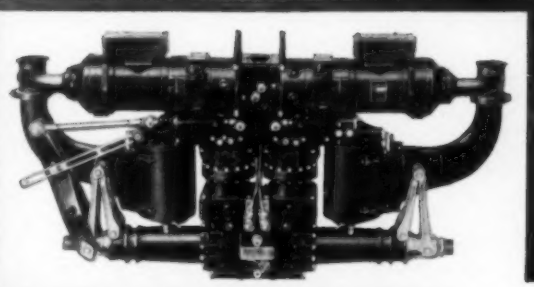

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